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Tar from Continuous Vertical Retorts.

[From a paper read by MR. T. STENHOUSE, Manchester Section, British Society Chemical Industry.]

As mere carbonizers of coal, when a large yield of gas is required, it is difficult to see how vertical retorts can be much improved upon. As regards residuals, it was expected that smaller quantities of coke and tar would result, but also an increased market value for the improved quality of tar. I do not think this expectation has been realized. So far, no increase in tar value has been apparent at Rochdale, where vertical retorts of the continuous type have been in use for nearly 18 months. There may, however, be a greater yield of tar per ton of coal carbonized, but this has not been proved, as circumstances do not allow of the tar from the verticals being kept separate. During the last 30 years the tar made at our works has been distilled and separated into such products as 50/90's benzol, solvent and heavy naphthas, crude carbolic acid, creosote oil and pitch. Ample opportunity has, therefore, been afforded of ascertaining the quality and quantities of the products obtained from tar derived solely from the horizontal and inclined retorts which were in use before the verticals were erected. The tar from the continuous verticals at Manchester has a specific gravity of only 1.074, compared with 1.113 for the tar from the intermittent verticals at Sunderland.

As the coal slides through the cold upper parts of the continuous vertical retorts, a considerable time elapses before it attains the highest carbonizing temperature of the setting. Probably a considerable portion of the coal entering each retort is subjected to low temperature carbonization, and the resulting gas, as well as the tar, must be richer in the saturated hydrocarbons of the paraffine series, but poorer in unsaturated and aromatic hydrocarbons. These tar-yielding vapors, given off in the upper part of the verticals, could probably be altered somewhat in character without destroying any of the saturated hydrocarbons of the gas itself, by being deflected to a slightly greater extent than is the case at present, to a hotter part of the retort before they escape by the ascension or descension pipe, as the case may be. This would cause some of the liquid low temperature paraffine products to be broken up into permanent gas and compounds richer in the benzene group. Especially might this be expected from the decomposition of the pseudo-olefines, like hexahydro benzene and its homologues. It has also been shown by Haber that hexane breaks up almost entirely into ethylene and methane at a comparatively low temperature. In the gas from the verticals, the unsaturated hydrocarbons seldom amount to more than 2.1 per cent., while the gas from the inclined retorts rarely gives less than 3.6 per cent. with the same class of coal. The gas from the verticals is poor in ethylene.

Respecting the quality of the tar, the following particulars may be given: When taken from the hydraulic main it is quite fluid, but becomes very viscid on cooling. After it has stood for a few hours at this temperature, patches of water separate on the surface. When this water is removed, the well-mixed tar, at 50° C., has a specific gravity of 1.09 to 1.10. After standing some time in the common tar well, the tar from the verticals contained much more water in suspension than that from the inclined retorts allowed to accumulate in the same way. This was very noticeable when the new tar was distilled; the tar had a great tendency to froth up and boil over; at the end of the condensing worm rushes of steam escaped irregularly, together with foul-smelling gases from the contained water, and small explosions in the still could be heard. It took several hours to get rid of the water before quiet distillation began. During the working of a tar still, a change of receivers was made from light oil to creosote oil at 4° T., and steam was applied to the boiling tar when the density of the distillate reached 7° T. In order that the hot pitch would run off freely and yield a medium soft grade, it was necessary to stop distillation when the anthracene oil was 13° T., at 15° C. If this 13° finish was not adhered to, the pitch would not run from the stills freely. With the tar from the horizontal and inclined ovens, however, the distillation had to be continued to at least 19° T., or the resulting pitch would be too soft.

The creosote oil from the old tar had a density of 9° to 10° T., with a tendency to become pasty and deposit naphthaline. With the advent of the new tar, the density of the oil began to fall until it stood at less than 3° T., and the oil remained quite fluid at 0° C., though much naphthaline was present. This creosote contained at least 16 per cent. of tar acids, but none of a crystallizable nature that could be sold as crude carbolic. Such creosote oil was obviously rich in cresylic acid. This low density creosote consisted partly of what

came from the distillation of the tar between 4° and 13° T. and partly of the oil residues from the light oil and naphtha stills when these were worked until the distillates became pasty on cooling. These latter residues were, therefore, sufficiently light and of sufficient quantity to reduce the whole of the creosote below 3° T., so long as the tar was entirely from the verticals. Owing to the low density of the oil, it is difficult to get it sufficiently free from water for commercial purposes. Some contracts for creosote oil stipulate that it must contain not less than 8 per cent. of tar acids, that the boiling point must not be less than 400° F., that at least 25 per cent. of the oil must not distil over at 600° F., and that the first 25 per cent. that does distil over must be heavier than water. The light creosote oil yielded by the tar from the verticals complied with the particulars just given, with the exception of the last one. The first 25 per cent. distillate was lighter than water. On the other hand, the oil contained twice the amount of tar acids required. Thus, paraffinoid compounds of a low specific gravity were present in much greater quantity than in creosote oil derived from ordinary coal tar.

The amount of phenol or crude carbolic acid obtainable from the new tar was at least 25 per cent. below the usual quantity, and the crystallizing point of the usual distillate fell from about 60° to 40° F. This decrease in quantity was due to the use of a weaker solution of caustic soda in order to obtain a crude acid that would crystallize and be merchantable.

From 800 gallons of the light oil given by the old tar from horizontal and inclined ovens, 40 gallons of 60's crude carbolic were readily obtained, but less than 30 gallons of a lower quality came from the new tar—all other conditions of treatment being similar. The new tar is, therefore, poorer in phenol, but richer in the acids of higher boiling points. In the usual distillation test for crude carbolic, a distinctly higher temperature than usual was reached before the required 62½ per cent. distillate was obtained, owing to the difference between the boiling point of carbolic acid and that of cresylic and other acids.

With the new tar came a smaller yield of benzol, but a larger one of solvent and heavy naphthas. Their composition and specific gravity also differed. For many years the density of benzol and solvent naphtha stood steadily at about 0.880, and that of the heavy naphtha at 0.910 to 0.920, but recently the specific gravity of the 50/90's benzol had dropped to 0.860, and that of the solvent naphtha to 0.845.

By fractionating either ordinary benzol or solvent naphtha, it was easy to obtain successive distillates having boiling points which rose steadily, while the specific gravities of the distillates decreased considerably; the residue in the flask—about 20 per cent.—was the lightest portion of all. That part of the solvent naphtha which distilled over between 140° and 160° C. would often have a density less than 0.840. The ordinary heavy naphtha, of which the tar from the continuous verticals gave a good yield, would give no distillate below 160° C, though the specific gravity did not exceed 0.880, and was often less, and, therefore, lighter than ordinary 90's benzol. It would appear from these results that the benzol and solvent naphtha contain appreciable quantities of the paraffine hydrocarbons which boil between 70° and 175° C. In the heavy naphtha and light creosote oil a greater percentage of the still higher members of the paraffine series must be present, all of which lower the density of the tar products in which they occur without materially affecting their boiling points or distillation properties. Tar taken from the hydraulic main and heated in porcelain dishes in an ordinary air oven gave 65 per cent. of medium soft pitch, or about 50 per cent. of very hard pitch. A similar pitch result was obtained when the tar was distilled in glass vessels without the aid of steam.

Judged by the experience with the continuous verticals at Rochdale, there is no naphthaline trouble with the gas, nor with the creosote oil or the naphthas, nor has there been any difficulty in selling the various liquid products at the ordinary ruling prices. It was different, however, with the crude carbolic acid, of which there was a considerable shortage in both quantity and quality. As tar from continuous vertical retorts becomes more plentiful throughout the country, it will be found, I think, that the large amount of tar acids present will cause much greater corrosion inside the tar stills.

It appears certain that in the near future ordinary gas works tar will contain a considerable amount of paraffine of low temperature compounds, particularly where carbureted water gas is also made, and this fact will have to be taken into consideration when the final products are placed upon the market. At present the quantity is probably insignificant, as even in gas works where vertical retorts have been installed, much more tar is obtained from the old plant than from the new, and the whole mixture will not show any great difference to the tar distiller.

In the discussion that followed the paper, attention was called to the light color of the tar, and the low content of free carbon in the tar and its pitch, the amount in the tar being but about 5 per cent. as against 15 to 25 per cent. in ordinary coal tar. This low percentage of free carbon, approaching the quantity found in natural bitumen, was expected to yield pitch very desirable for road making, etc., but actually the pitch seemed very brittle and not any more valuable than that from coal tar.

[Official Report.—Revised by the Secretary.—Concluded From Page 311.]

PROCEEDINGS, NINTH ANNUAL MEETING, ILLINOIS GAS ASSOCIATION.

Held in La Salle Hotel, Chicago, March 19 and 20, 1913.

Second Day—Morning Session.

The President introduced Mr. H. L. Farrar, who read the following paper on

A CONVENIENT AND REASONABLY ACCURATE PHOTOMETRIC SUB-STANDARD.

In the report of the committee on methods of taking candle power of gas,[1] is found an interesting discussion of the practicability of the incandescent electric light as a photometric standard, and it is stated there "That incandescent lamps, under proper electrical conditions, proved especially constant light sources. In addition they possess two excellent properties, the color of their light may be adjusted to that of the compared light, and are portable on the photometer bar without disturbance of their illuminating power." The committee, however, enumerates the following objections: "As a working standard the cost of installation of a storage battery, equipped for re-charging, with duplicate voltmeter and resistance coils, would be about $700. The battery must be charged by direct current; the lamps must be kept clean; there must be several of these for the purpose of checking one against the other; care must be used that the lamp is not subjected to a voltage above its rated one; the voltmeter itself must be checked from time-to-time; the cost of recharging must be considered, as well as renewal of batteries. For these reasons it is not a portable system. It does not vary with the flame under atmospheric changes, and consequently is absolutely unfair as a standard in gas photometry."

Since this report was made the situation has been much altered by the development of the cheap and efficient automobile storage battery, and of reliable tungsten lamps of corresponding voltage. It is the purpose of this article to describe a series of tests which have been made to determine the reliability and convenience in ordinary practice of a sub-standard, consisting of a 6 volt tungsten lamp of from 8 to 10 candle power, deriving its source of energy from a 6-volt, 80-ampere automobile battery.

Reverting for a moment to the objections enumerated in the committee's report, that of cost disappears at once in the comparatively low cost of these batteries; recharging is easily accomplished at nominal expense at any automobile station or any electric plant; the lamps are easily kept clean and their cost is low; the battery with ordinary care in charging will not give excessive voltage; the battery and lamps are easily portable. For sub-standard work the lamps may be standardized at any initial battery voltage. Resistance coils are not required and voltmeter readings are of only minor importance for checking over-use of battery, and, as the tables will show, may, within any reasonable number of tests, be safely omitted. There remains only the final objection that the electric lamp does not vary with the flame under atmospheric changes. Admitting this to be true as a criticism in considering an ultimate standard for the finest laboratory practice, its influence in everyday commercial work may be found to lie within the ordinary limit of error of that work, which point will be further discussed in considering the tests given below.

It will be readily recognized that any convenient and portable photometric standard will have a wide range of usefulness, even should its accuracy not be absolute, and even if it be considered only as a sub-standard. There are many occasions in which frequent and rapid determinations of candle power by comparatively inexpert

1. Proceedings, Am. Gas Inst., 1907; pp. 474. 5 and 6.

operators are desirable, and where a reasonable percentage of error on a bar photometer is far better than no test at all. There are also many conditions in which easy portability is one of the prime essentials, and there are situations where cost and lack of expert ability are determining factors.

The sub-standard investigated consisted of a 6-volt tungsten lamp, with a 6-80 automobile battery as a source of energy. The tests with this sub standard were made on mixed coal and water gas. A regulation photometer table equipped with a 60-inch bar was used; the gas was burned in a Sugg, D-Argand, and the checking standard used was a Harcourt, 10-candle power pentane lamp, standardized by the United Gas Improvement Company. The stock lamps first purchased proving unreliable, correspondence was entered into with the National Lamp Association, through which a carefully aged and manufactured 12-watt lamp, giving approximately 10-candle power, was obtained at a cost of $1.51, which lamp has given perfect satisfaction. It was ascertained early in the work that care in the establishment and maintenance of all parts of the electrical circuit was of absolute necessity, and that especially only the very highest grade copper switches should be used. A volt meter of moderate cost for checking battery conditions was also found convenient, but would not be absolutely essential within the range of usefulness finally indicated. Color difficulties were experienced from the start, but were overcome by the use of a small glass screen, placed directly in front of the stand of the electric lamp and coated with prepared Japan amber lacquer mixed with amyl acetate, by which a light of exactly the same color as the gas light was obtained.

With some light already thrown on possible results by these preliminary tests, the scope which the investigation should cover was carefully considered. It was decided that the electric standard should be considered solely as a sub-standard, thus eliminating the influence of initial battery voltage and initial electric conditions. Given, therefore, a battery charged with ordinary care, and an electric circuit and lamp with its candle power determined by reference to a pentane lamp, it was decided that the questions to be considered should be:

1. Battery conditions.
2. Corresponding lamp conditions.
3. Time limit between standardizations.
4. Personal error influences.
5. Atmospheric influences.
6. Lamp curve.

Table A shows the voltage drop in the battery, and the corresponding drop in the candle power of the electric lamp during 100 tests of 5 minutes each, made without recharging the battery. These tests were not continuous, but were made as tests would ordinarily be made; that is, with a reasonable time intervening, and consequently less strain on the battery, it being recognized that a battery drops more in voltage with constant use than with intermittent use. The voltages used are in all cases the steady voltages after the 3-minute interval of initial drop.

TABLE A.—*Showing Drop in Candle Power of Electric Lamp and Voltage Drop in Battery with Reference to Time Used.*

Number Tests 5 Mins. Each.	Drop in Voltage, Storage Battery.	Drop in Candle Power Elec. Lamp.	Approx. Error in Test of C. P.—Gas, Due to Electric Standard.— Candle Power.	Per Cent.
10		0.1	0.15	0.9
20	.01	0.2	0.30	1.8
30	.03	0.4	0.60	3.5
40	.05	0.5	0.75	4.4
50	.08	0.7	1.05	6.2
60	.11	0.8	1.20	7.0
70	.14	0.9	1.36	8.0
80	.16	1.1	1.66	9.8
90	.19	1.2	1.80	10.7
100	.22	1.4	2.10	12.4

Table B shows the candle power obtained, first, with the pentane lamp, and immediately afterwards with the electric standard, the electric standard having been standardized just previous to the tests by the pentane lamp.

Table C shows the candle power taken over a period of several tests with the pentane lamp, and immediately afterwards with the electric lamp. The electric lamp was standardized the first time, but not re-standardized afterwards, nor was the battery recharged.

Table D shows similar tests extended over 30 observations made 12 different days. This test followed the test of Table C, but before starting it the lamp was restandardized.

TABLE B.—*Showing Candle Power of Gas Obtained with Pentane Standard and Candle Power of Gas Obtained Immediately Afterward with Electric Standard.*

C. P. of Gas, Pentane St.	C. P. of Gas, Elec. Stand.	C. P. of Gas, Pentane St.	C. P. of Gas, Elec. Stand.
18.0	18.3	17.0	17.2
17.4	17.3	18.0	18.3
17.7	17.6	18.4	18.6
18.3	18.5	17.7	17.8
18.0	18.1	17.7	17.7
17.9	18.0	18.7	18.5
17.8	18.0	17.0	17.2
17.1	17.0	17.7	17.8
18.1	18.1	17.1	17.2
17.5	17.4	17.0	17.1
17.9	17.7	16.7	16.6
18.5	18.6	18.1	17.9
18.5	18.6	17.7	18.0
18.0	18.0	17.2	17.1
18.0	18.1	16.8	17.1
19.3	19.2	17.2	16.9
17.8	18.0	15.9	15.9
17.6	17.8	16.3	16.6
18.2	18.3	16.9	17.1
17.3	17.6	17.0	16.9

TABLE C.—*Electric Lamp Standardized as* 10.87 *C. P.*

Date.	Time.	Gas by Pentane.	Gas by Electric.
Jan. 9th	A.M.	17.9	18.2
Jan. 9th	P.M.	19.0	19.2
Jan. 10th	A.M.	17.2	17.2
Jan. 10th	P.M.	18.4	18.6
Jan. 11th*	A.M.	18.6	18.9
Jan. 12th	A.M.	16.6	16.9
Jan. 12th	P.M.	17.1	17.4
Jan. 13th	A.M.	15.7	16.1
Jan. 15th	P.M.	17.2	17.4
Jan. 16th	A.M.	16.7	17.1
Average		17.44	17.70

*On the afternoon of the 11th, twelve tests of approximately 4 minutes each were made with the electric standard and battery at an outlying station.

TABLE D.—*Electric Standardized as* 10.47 *C. P.*

Date.	Time.	Gas, by Pentane.	Gas, by Electric.
Jan. 16, 1912	5:30 P.M.	17.27	17.18
Jan. 17, "	9:00 A.M.	17.59	10.38
" "	1:45 P.M.	18.17	18.20
" "	4:00 P.M.	18.37	18.25
Jan. 18, "	8:45 A.M.	17.85	17.87
" "	1:45 P.M.	17.90	18.00
" "	4:00 P.M.	18.52	18.50
Jan. 19, "	8:45 A.M.	17.18	17.23
" "	1:30 P.M.	17.83	18.03
" "	4:00 P.M.	18.03	18.06
Jan. 20, "	9:00 A.M.	17.56	17.88
" "	2:00 P.M.	18.57	18.69
Jan. 22, "	11:30 A.M.	18.10	18.40
Jan. 23, "	8:30 A.M.	17.88	18.15
" "	4:30 P.M.	16.91	17.07
Jan. 24, "	9:00 A.M.	16.75	16.91
" "	1:30 P.M.	17.21	17.49
" "	4:00 P.M.	17.40	17.55
Jan. 25, "	9:00 A.M.	17.38	17.55
" "	1:30 P.M.	17.57	17.82
" "	4:00 P.M.	17.70	18.12
Jan. 26, "	8:45 A.M.	17.47	17.75
" "	1:30 P.M.	17.40	17.79
" "	4:00 P.M.	17.22	17.75
Jan. 27, "	8:45 A.M.	17.06	17.43
" "	1:30 P.M.	17.66	17.96
" "	4:00 P.M.	17.36	17.61
Jan. 29, "	8:45 A.M.	17.40	17.90
" "	1:15 P.M.	17.60	18.10
" "	4:00 P.M.	17.70	18.32
Average		17.62	17.83

From these tests and many others which could be quoted, but are too similar to be of additional interest, the conclusion has been reached that, as a sub-standard where the utmost of accuracy is not required,

the electric lamp offers very interesting possibilities. Some of these are perhaps best illustrated by a description of the actual use to which it has already been put in our Company.

Some 15 stations within our distributing area have been fitted up with a substantial, homemade photometer table and bar, provided with brass scale carefully marked. At the central test station is maintained a full laboratory equipment, with a pentane lamp as a standard, by which the electric sub-standard described in this article is standardized from time-to-time, according to the frequency of its use. The operator takes to each outlying station a battery and lamp, a sight-box, test meter and test burner. This outfit, although heavy, can be carried by hand. Observations are made quickly without any of the frequent difficulties experienced in using the pentane lamp, and without any of the danger and difficulty of transporting and storing the pentane. We have 4 outlying stations, aside from the central station in Aurora, that are equipped with permanent installations, but without pentane lamps. In place of transporting this from the central station, or attempting to use the Methven screen standardized from time-to-time, these stations are supplied at stated intervals with battery and lamps sent out from the central laboratory, to which they are returned in due course, the lamp to be restandardized and the battery to be recharged. To save time one extra battery is kept on hand and the outlying station is supplied with a complete, new, standard battery, lamp and screen before the first one is returned to the central station for restandardization. It is also felt that, on the whole, the observations will average as accurate as if the ultimate standard were used. It must be borne in mind that absolute accuracy demands more than an absolute standard. It demands, above all, an experienced, careful operator with abundance of time at his disposal. The average small gas works can not invariably meet this condition, and it must be conceded that a test once or twice daily, correct within three-tenths of a candle power, is better than absolutely accurate tests at infrequent intervals, and far better than tests made with a fine apparatus vitiated by haste or other carelessness.

The electric sub-standard offers interesting possibilities for a group of small companies desiring to do reasonably accurate photometric work at a minimum of expense and without the necessity of great experience. Thus a group of small companies would establish one central testing laboratory, from which batteries and lamps could be sent, and to which they could be returned within the time limit of safe use. The equipment of each company in such a group would consist of a photometer table, sight-box, meter and test burner set up under proper conditions.

The question of time limit of checking lamps is indicated somewhat in the Tables C and D. An interesting possibility, however, is that of extending this time limit by the interpolation of Table A. Repeated tests have been made along this line, and in all it has been found that the drop in candle power, with reference to the number of 5-minute tests, is practically the same as shown in the Table A, up to the limit of 40 or 50 tests. In practice, however, I find that the operators are apt to burn the lamp more than 5 minutes for some of their tests, and that it is sometimes necessary to make a second test for a check, for which reason we cut the value of the standard 0.1 candle power for each week of use, when one test per day is scheduled. When the standard is returned to the central station it is tested against the pentane lamp again in order to keep a check upon this phase of the work.

In regard to the life of the lamp itself, we are still using one lamp that was put into service over 2 years ago. This lamp was used in practically all of the experimental work, and since then has been used constantly in practice. Although it has shown a slight drop in candle power, comparing its present candle power at any one voltage with its original candle power at the same voltage, it has not shown any perceptible curve downwards to an extent that would affect any one series of tests. The light curve of the tungsten lamp is, of course, far superior for test purposes than that of the carbon lamp, remaining nearly horizontal during the entire life of the lamp, and then dropping suddenly.

Discussion.

Mr. Hotchkiss—It is well known what effect atmospheric and other conditions have on the pentane and open gas flames, and I also notice the tests are dated January, 1912, which was an exceedingly cold month. In fact, during 12 days of that month the temperature was below zero. On such days the air will be very dry and the pentane flame would probably be giving its maximum amount of light. This paper speaks of a standardized pentane lamp, but it must be remembered these lamps are standardized under a condition of 8 liters of water vapor per cubic meter and a pressure of 760 millimeters. These tests being made under these conditions, Mr. Farrar will be getting practically the standardized value from his pentane lamp. Under such conditions he doubtless gets consistent results, as the value of the gas flame would undergo practically no change between standardizations of the electric unit by the pentane lamp. In other words, he is working under ideal conditions. It has been established, regarding the pentane lamp, that 1 per cent. increase of aqueous vapor in the air deteriorates the candle power about 6¼ per cent. Using the correction formula given by the Bureau of Standards of the United States, and assuming a not uncommon case, with a barometer of 28 inches and the humidity at 15 liters, the lamp would give 9.3 candles. If we standardized the electric unit under these conditions, we would be over-rating the lamp about 7 per cent. By using this value for the electric standard, say on the same day, our gas flame would be affected in much the same percentage, and there would be little or no change. However, on a fair day, using the value of the electric lamp, as obtained under the above conditions, it might be possible to indicate a candle power of the gas flame at least 7 per cent. (possibly more) too high. If the electric unit were standardized under conditions such that the pentane lamp was yielding its rated candle power, then, by using this value of the electric unit for a test against the gas under less favorable conditions—*e. g.*, the same as given above—the candle power of the gas flame might be 7 per cent. or more too low. I would like to ask Mr. Farrar if he has conducted any such tests in the summer, especially under the extremely poor conditions such as I mentioned as regards humidity, etc. In Table B was the electric unit standardized previous to each test by the pentane? As a matter of interest, how often are these electric units actually standardized by means of the pentane lamp? In Table D, was the electric light standardized during the 12 days; that is, exclusive of the original standardizing? I should like to see just what results could be obtained under really unfavorable conditions.

Mr. Rice—The objection as to humidity and its influence is certainly well taken; but it must be borne in mind that this objection is against the use of the electric lamp as an ultimate standard. Very early in the experiment it was recognized that it would be out of the question to attempt any argument for the use of an electric lamp as an ultimate standard. In using this lamp as we do, it is restandardized frequently. Probably the maximum period would be 1 month. That is really the maximum use, because in that length of time the battery voltage has dropped and it would be no longer safe to continue its use. When you recharge your battery you again establish a candle power of the lamp. The only effect which humidity can have thereafter is the change of atmospheric condition during the period the lamp is away from the testing station, and our experience has been that at all seasons of the year the lamp remains out such a comparatively short time that these changes, although they exist, are within the limit of error expected. The whole paper centers around the one fact that this is not an attempt for absolutely accurate photometric work. Absolutely accurate photometric work depends on more conditions than that of the standard. There are stations operating to-day with good ultimate standards where the results could not be accepted by the Bureau of Standards at Washington because of other factors. There is no attempt to set up that this is absolutely accurate photometric work, but there are many conditions where it is much better to have frequent tests made, within a limit of error which you are willing for that reason to allow, than to have no tests at all; and it is better to have a test made where you allow and expect an error of 3 or 4 tenths of a candle power, and know you get it, than to think you are doing ultimate and accurate work and really not getting it. In our work we have a distribution area extending over about 700 miles of pipe and a large number of small offices. I will say frankly that we can't afford to set up 15 or 20 testing stations and do absolutely accurate photometric work, nor have we sufficient skill at our command to obtain absolutely accurate tests daily at 15 or 20 stations. But by the use of this system we do get from those stations frequent tests, From some we get daily tests, which show us the general characteristics of the gas as to candle power delivered at those stations. Some years ago, in operating a water gas set at a small works, a problem that confronted me was to follow the light curve of the water gas machine during the process of manufacture. We had at that works during the greater portion of the day only a gas maker in charge, and it was absolutely out of the question to expect him to make accurate photometric tests. We used the Methven screen, and it proved (as it has proved everywhere) very unsatisfactory. We attempted to set up an installation similar

to that suggested in this paper, but did not have the battery or tungsten lamp. We went to the expense of a wet battery, but having only carbon lamps the experiment did not prove very satisfactory. To-day an apparatus of this character placed in such a works would prove very advantageous and could be quickly and safely used by the gas maker running down from his machine occasionally and putting in 5 minutes to determine approximately the candle power he was getting.

The President—If no one else has anything to ask, Mr. Farrar will reply.

Mr. Farrar--We haven't made any tests, taking humidity into consideration. In Table B the electric standard was standardized before each test. While that allows for personal error it does not show the atmospheric influence, unless there was a sudden change at that time. As I said before, Table B extended over a period of 15 days, and the electric lamp was not standardized during that time. These did not show any difference due to humidity, the greatest difference here is about the 25th or 26th test where we have one of $\frac{6}{10}$ of a candle. That difference was not only due to personal error and atmospheric influence, but was due to the drop in voltage of the battery. Our battery and lamps are always brought to the central laboratory once each month no matter how many tests have been made with it, but we ordinarily run only one test per day at these outlying stations, and as we cut the candle power of the electric standard $\frac{1}{10}$ of a candle power for each week, that error is very little.

Mr. Hotchkiss—In trying out that idea of standardizing a lamp, you might secure a small certified electric unit from the Bureau of Standards and determine the candle power of the pentane lamp under favorable conditions as regards humidity, etc., and then, without having used the certified lamp, check up the value of the pentane lamp under unfavorable conditions and note the variation.

Mr. Farrar—I would like to ask Mr. Hotchkiss if he thinks there would be as great an error as 7 per cent. in the pentane lamp? Would the gas flame vary as much as the pentane?

Mr. Hotchkiss—The gas flame will vary practically in the same proportion as the pentane, being afflected slightly more by the same amount of aqueous vapor.

Mr. Rice—The point seems to be that the pentane lamp varies even to changing its value in the summer time. As the gas flame does the same, and the two have been determined to be in pretty close proportion, so that the pentane lamp is generally recognized as being free from this influence as a standard. All we are doing is putting the electric lamp in place of the pentane lamp for determining some one day in the summer time, if you will, what the value is in comparison with the pentane that day, when the pentane has varied and the gas has also. On that day, the electric lamp being rated by the pentane lamp, there can be absolutely no difference in the tests. The two are identical. The next day a change in humidity may have occurred and both the gas and pentane vary; but as the electric lamp hasn't varied, therefore your test would be inaccurate that day. It all comes to the question of how much that change will be during the period that the electric lamp remains not re standardized. Our experience is that the change during the period that the lamp is allowed to remain out is not sufficient to vitiate the tests more than .3 of a candle power. You must not regard the paper or experiment as confined to January, 1912, because, although the paper cites those tests, it can just as well recite the tests that have been made continuously since that time. We used this method all last summer, and expect to go on using it this summer.

Mr. Spitzglass—There is certainly a difference between apparent candle power and absolute candle power, and as we are not concerned with the actual candle power, but with the apparent, so if a lamp has 10 candles it will have it just the same with the electric lamp as with the pentane, and while that will be absolute candle power, it may not be the apparent candle power. We have 10 pentane and 10 electric, and there may be 22 actual and 20 apparent. We are after the apparent candle power; but as long as there is no change in the humidity it is mathematically correct to use the electric lamp, and if the humidity is the same it will be also the same with the standard of the pentane lamp.

Votes of Thanks.

Mr. Rice—I am about to offer a resolution of thanks to our officers, but, first, just a word. We are about to go out from this meeting, which was a glorious one. When I look back on that meeting in the Congress Hotel, a few years ago, a mere handful of members, I am filled with amazement at the growth of our Association; 95 new members! I could hardly believe my ears. But we must not be too complacent of our well being. Nothing else is more fatal So let us, one and all, resolve to do our share during the coming year. We must round out that efficiency curve, filling up the hollows, since it is not right that we be enthused for a short time, and then go back to our desks and forget it all. So, let us bear this in mind and let nothing keep us from doing all we can for the future growth of the work of the Association. Having had a great meeting I move we offer a rising vote of thanks to our President and Secretary and to the Chairman of our Entertainment Committee; also to all the officers and directors and committee workers who have brought this meeting about. [Seconded and adopted unanimously by rising vote of thanks tendered to the officers.]

The President—I want to thank the members on behalf of Mr. Clark and myself, as well as for the Entertainment Committee; I think we have had a very good meeting.

The convention was thereupon declared adjourned.

Description of the Gas Kitchens in the Hotel McAlpin.

[Prepared for the Journal by Mr. Harold L. Alt.]

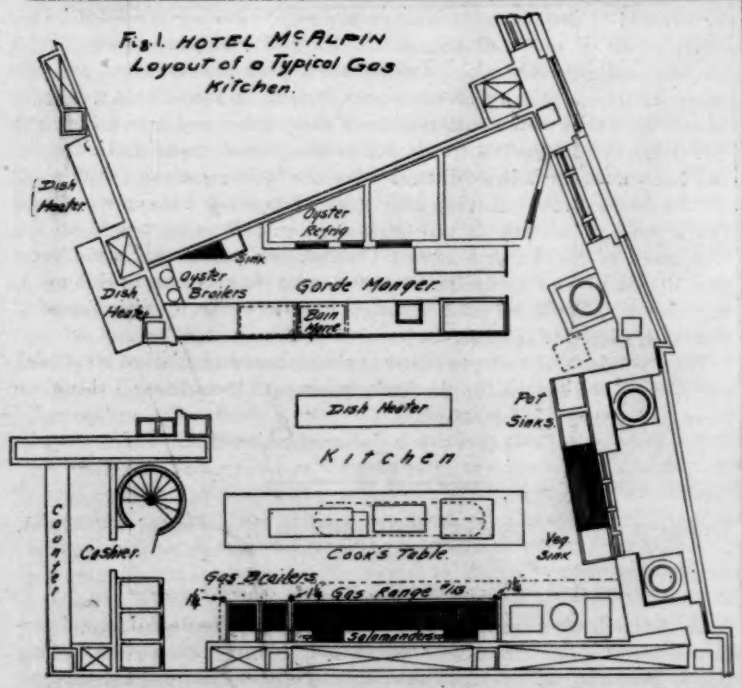
Recently thrown open to the public was the wonderful Hotel McAlpin, located on Broadway between 33d and 34th streets. This hotel, which is probably the most up-to-date and thoroughly modern of any in the city, being popularly known as the hotel of the 1,000 bathrooms, owing to the multiplicity of its toilet and bathing facilities. To be exact, there are really 1,100 private baths and 1,500 guest rooms. The structure itself towers 25 stories above the street, its 3 sub basements dropping some 60 feet below. In regular operation it will require not far from 1,500 hotel employees and accommodations are furnished for 2,500 guests, these constituting a total population of approximately 4,000 people. The building, which is as fireproof as modern science can make it, was erected by the Thompson-Starrett Company, General Contractors, and the plumbing work was installed by Charles H. Darmstadt, New York city, the total cost of the structure being approximately $13,500,000.

The 22d floor of the hotel is set apart for the exclusive use of men, and is known as the "Men's" (or "Club") floor. Connected with this, by a special stairway, are Turkish and Russian baths, located on the floor immediately above, and the male guests' interests are further taken care of by another novelty situated on the "Second Mezzanine" which is the "Men's Lounge"—a long gallery fitted up in the manner of a sumptuous clubroom, with easy chairs, library, smokers' necessities, bar, stock-ticker and public stenographer.

The needs of the ladies have not been overlooked by any means, the "Women's Club" floor, supplying accommodations for women traveling without escorts, together with shopping guides and chaperones. Supplementing the "Women's Club" is the Ladies' Cafe, where gentlemen are allowed only when acting as escorts. Other banquet and dining rooms are scattered about, with varying capacities to serve from half-a-dozen diners to several hundred. One of the most important and unique rooms in the hotel may be noted in the restaurant, or "Terra Cotta Grill," as it has been properly christened. The striking novelty of this restaurant consists of the telephone service to the tables, which seems to keep the busiest business man in close touch with his outside interests at all times.

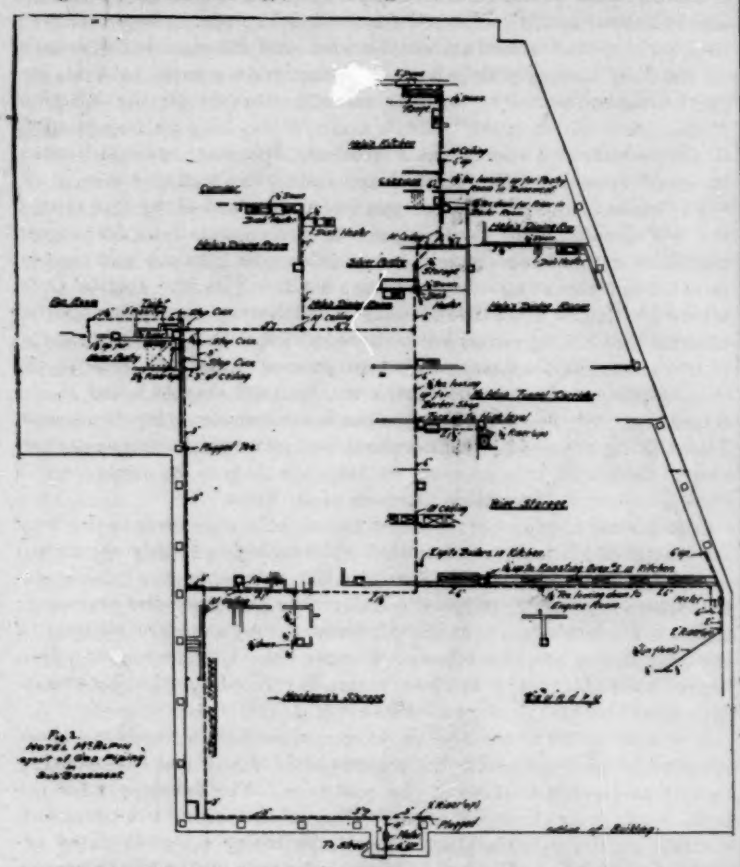
It is desired to especially call attention of our readers to the way the matter of kitchens was handled. Naturally, to supply restaurant accommodation for a community of 4,000 people, in the most up-to-date manner possible, required considerable ingenuity and planning; and it is a notable fact that the kitchens throughout are entirely of the type known as gas kitchens. For the benefit of the reader a plan is presented of a typical kitchen, which is located on the first mezzanine floor and arranged as shown in Fig. 1.

It will be noted there are no stoves whatsoever, excepting those supplied by gas, gas oyster boilers, gas boilers and gas ranges being used in preference to those of the coal type. The gas supply for the hotel is run from the street to the ceiling of the second sub-basement, where a gas meter is installed. From the meter a 3-inch main extends to the kitchen supply and laundry fixtures, with a $\frac{3}{4}$-inch branch to the barber shop and hair dressing parlor. The main then reduces to $2\frac{1}{2}$ inches and is run to the pipe shaft at column 68, up which it is extended to the 24th floor. From the main in the second sub-basement is taken off a $\frac{1}{4}$-inch connection, near the central portion of the engine and pump room, and a $\frac{1}{4}$-inch connection in the boiler room.



On the first floor are ¾-inch connections for each shop and ½-inch connection is run to the cigar stand. Each shop is equipped with its own separate meter, so that the gas supply may be charged separately. Branches of ½-inch size are run to each pantry, to bracket lights, on platforms of stairways, at columns 63, 70 and 30. and also to outlets at the end of the elevator hall on each floor, from the 3rd to 24th inclusive. At column No. 68, on 23d floor, is taken off a ¾-inch supply to the valet's room, another ¾-inch to the upholstery room, and a 1-inch branch to the service laundry. On the 24th floor a ¾ inch branch is run to the corridor of the Turkish bath, and a ½-inch connection to barber shop, with another ½-inch connection to the mantels in a special room.

Fig. 2 shows how the gas is brought in and run around the sub-



basement ceiling and the branches supplying the kitchen above on the basement level. It will be noted that the dish heaters in the silver pantry, helps' dining rooms, the ranges in the helps' kitchen, etc., are all gas supplied, this supply being brought in through a 6-inch service and meter as shown. All the gas piping is arranged to drain toward the point of supply, and is installed with all the applicable requirements for water piping. On the house side of the meter are gate valves and drips, and all branches are valved at the running lines. The sizes are limited to a minimum of ½-inch for runs not exceeding 25 feet; ¾-inch for runs less than 40 feet; 1-inch for runs less than 60 feet; and 1¼-inch for those not exceeding 100 feet. Larger sizes are, of course, used where the appliances supplied require them. The piping, fittings and fixtures are all installed according to the rules and regulations of the "New York Plumbing Code" with which our readers are doubtless familiar.

The Combustion of Carbon.

Messrs. Thos. F. E. Rhead and R. V. Wheeler, continuing the reporting of their studies respecting this topic, have communicated to the "Journal of the Chemical Society," the results so far attained. The history is rather verbose, and it is certainly voluminous, but in a well-worked out summary thereof the investigators thus narrate the record:

In previous papers we have shown that a consideration of the relative rates of the various reactions between oxygen, carbon monoxide, carbon dioxide and carbon leads to the conclusion that, in the burning of carbon, the two oxides are produced simultaneously. That is to say, neither is the "primary" product of oxidation of carbon in the sense that it takes precedence over the other.

In the present paper we describe experiments on the strength of which we put forward an hypothesis as to the manner in which solid carbon burns which appears to us to leave no known fact unexplained.

The experiments show that carbon, at all temperatures up to 900°, and probably above that temperature, has the power of pertinaceously retaining oxygen. This oxygen cannot be removed by exhaustion alone, but only by increasing the temperature of the carbon during exhaustion. When quickly released in this manner it appears, not as oxygen, but as carbon dioxide and carbon monoxide. The proportions in which it appears in these two oxides when completely removed depend on the temperature to which the carbon has been heated during oxygen-fixation.

No physical explanation alone can account for this "fixation" of oxygen, but, in all probability, it is the outcome of a physico-chemical attraction between oxygen and carbon. Physical, inasmuch as it seems hardly possible to assign any definite molecular formula to the complex formed, which, indeed, shows progressive variation in composition; chemical, in that no isolation of the complex can be effected by physical means.

Decomposition of the complex by heat produces carbon dioxide and carbon monoxide. At a given temperature of decomposition these oxides make their appearance in a given ratio. Further, when a rapid stream of air at a given temperature is passed over carbon (which has previously been "saturated" with oxygen at that temperature), carbon dioxide and carbon monoxide appear in the products of combustion in nearly the same ratio as they do in the products of decomposition of the complex at that temperature.

Our hypothesis is that the first product of combustion of carbon is a loosely-formed physico-chemical complex, which can be regarded as an unstable compound of carbon and oxygen of an at present unknown formula, C_xO_y. It is probable that no definite formula can be assigned to this complex.

Our conception of what takes place during the combustion of carbon is, briefly, as follows: Each oxygen molecule that comes into collision with the carbon becomes "fixed," in so far as it is rendered incapable of further progress by the attraction of several carbon molecules. We have as yet no absolute knowledge of the number of atoms contained in the carbon molecule. The formation of benzenehexacarboxylic acid (mellitic acid) by the oxidation of either amorphous carbon or graphite warrants the assumption that the carbon molecule cantains not less than 12 atoms, arranged as two concentric benzene nuclei. According to Aschan, this does not harmonize with the strain theory; for whilst carbon is an extremely stable substance, the strain in such a molecule must be greater even than that in a molecule of an explosive substance such as acetylene. On several grounds, which are discussed at length in the original paper, Aschan suggests an unstrained arrangement of the benzene nuclei.

It may be therefore, that in the oxidation of carbon the oxygen molecule actually *enters* the carbon molecule, a rearrangement of atoms taking place. However, for the present it is sufficient to assume that several carbon molecules hold one oxygen molecule, in

bond as it were, and do not allow it to escape in conjunction with one of their atoms. A considerable evolution of heat takes place during this attachment of oxygen molecules, so much so that some of them eventually acquire sufficient energy to seize hold of a carbon atom and depart with it as carbon dioxide. Some of them become torn apart in the process – become atomized – and leave the carbon molecule as carbon monoxide.

This formation of a complex, and partial decomposition as fresh oxygen molecules become attached, goes on until the carbon becomes "staturated," the products of combustion during this period (a comparatively short one) being C_xO_y, CO_2 and CO.

After the carbon has become saturated there is an alternate formation and decomposition of the complex. Each oxygen molecule that impinges on the carbon is at once seized hold of to form the complex, but the energy set free when this occurs decomposes an equivalent proportion of the complex formed from previous oxygen molecules. So that, finally, when air is passed over saturated carbon maintained at a constant temperature by the application of an external source of heat, carbon dioxide and carbon monoxide appear in the products of combustion in volume sufficient to account for the total volume of oxygen in the air originally passed.

In the normal burning of carbon, therefore, the carbon dioxide and carbon monoxide found as the apparently primary products of combustion, arise from the decomposition, at the temperature of combustion, of a complex the formation of which is the first result of the encounters between oxygen and carbon molecules.

The idea of "oxygenation" of the combustible as a preliminary to definite chemical reaction is not without precedent. The researches of W. A. Bone and his co-workers on the combustion of hydrocarbons point unmistakably to a preliminary *entrance* of the oxygen into the molecule of the combustible, an unstable complex being formed, which breaks up immediately into definite chemical compounds. Thus, in the case of methane, the scheme of reaction is probably:

$$CH_4 + O_2 = (CH_4O_2) = H\,CHO + H_2O.$$

Formaldehyde has been isolated during the slow combustion of methane over a heated surface and in the flame of methane burning in air, and its presence has been indicated during the propagation of "inflammation" in explosive mixtures of methane and oxygen. Moreover, there is no evidence of any essential difference between the "detonation" and "inflammation" of the paraffines, so far as the result of the *initial* encounters between molecules of hydrocarbon and oxygen are concerned. That is to say, even for the most rapid oxidation, the transitory formation of oxygenated complexes may take place.

There seems to us to be nothing to conflict with the supposition that in general it will be found that the initial encounters between oxygen and a combustible material result in the "fixation" of the oxygen, and that the products of combustion that make their appearance are the result of decomposition of a complex first formed. It may be pointed out that the work of Dixon, referred to in a previous paper, on the explosion of the gaseous carbon compounds as exemplified by cyanogen, shows merely that in this case carbon monoxide is produced before carbon dioxide; it does not in any way negative the possibility of the transitory formation of an intermediate combination.

Wastes in the Production and Utilization of Natural Gas.

The history of the natural gas industry of the United States is an appalling record of waste, according to Messrs. Ralph Arnold and Frederick G. Clapp, authors of Technical Paper No. 38, of the United States Bureau of Mines. This paper which has just been issued, contains these statements:

There was evidently no great waste of gas in this country before 1873, as no large fields had been discovered, although gas was always wasted in oil production. In 1878, a well, of great volume and pressure, was struck at Murraysville, Pa., 20 miles east of Pittsburgh, the gas from which was allowed to waste for 3 years, no effort being made to check it. The belief that natural gas was inexhaustible seemed universal at this time, just as in later years a similar opinion prevailed regarding the forests, coal, and many materials. So it was not until 15 or 20 years after the first utilization of natural gas that the pronounced decline in production caused the truth to dawn upon producers (and consumers) that the supply was indeed limited. The waste of natural gas has drawn the attention of the entire country, and, because the waste threatens the life of gas fields, it has prevented many investors from building plants, thereby depriving the localities of increased population and wealth. In considering the question of waste it must be understood that the geologic occurrence of the gas in the sandstone, sand, or limestone reservoirs is such that the flow of gas from one well causes a decrease in the flow of others, and a general reduction of the supply throughout the entire field. Instances are common where carelessness and indifference in drilling have resulted in waste of gas from formations penetrated above the regular sand. If the formations are loose, the gas sand fairly shallow, the pressure great, and the proper precautions are not taken in setting the casing, the gas may escape around the casing, loosening the ground, and ultimately gaining sufficient volume and pressure to blow the casing from the well. Such "blowouts" have happened a number of times in the Texas and Caddo fields, and are likely to occur in the first wells drilled in any field, before the conditions attending the gas pockets are generally known. Some excuse may exist for the occurrence of one such "blowout" in a new field, before the presence of the high pressure gas pocket is known, but there is usually little reason for a second or a subsequent "blowout" because precautions can be taken to prevent it. Waste in drilling is not so great as formerly, because at the present time drillers have usually every facility at hand to close a well as soon as completed. By proper preparation most wells can be packed, tubed and shut in within 2 hours. According to the Conservation Commission of Louisiana, the waste from the two principal "wild" wells in Louisiana had its beginning more from a lack of knowledge of what precautions would be effective than from negligence or indifference. The waste from the first big gas well encountered in drilling for oil in the Buena Vista Hills' field, of California, was due to the unexpectedness of the great flow and to local inexperience in handling such pressures. This well was controlled only after a Texas operator had been engaged to do the work. The most notorious waste at present is in Oklahoma, Louisiana and California. The Commission on the Conservation of Natural Resources in Louisiana, after an exhaustive examination of the situation in the Caddo field, found that the waste approximated 75,000,000 cubic feet per 24 hours, an amount equal to 20 times what the city of Shreveport uses in the same space of time and equal to one-twentieth the quantity consumed in the entire United States. It also found that the value of the gas wasted from a single "wild" well in that State was in excess of $2,000 per day. There were 3 principal wells in the Caddo field from which the greater part of the waste occurred. They were known locally as the "dry gas well," the "mud gas well," and the "salt gas well." Two of these have been closed by the owners, thus proving that closure is feasible. No attempt has been made to close the other, and when visited by Mr. Clapp (February, 1912) it consisted of a crater perhaps an acre in extent, in the center of which the gas was forcing a geyser-like mass of mud and water to a height of 20 or 30 feet. During much of the time this well is burning, and the gas has been going to waste for 3 years. Two other wells, having an estimated volume of 20,000,000 or 30,000,000 cubic feet per day, blew out and burned for 1 or 2 years. In the Caddo field at least 400,000,000 cubic feet of gas has at times been wasted daily, practically all the waste being preventable. McDowell states that the daily waste of gas in Oklahoma, by escape into the air, is equivalent to at least 10,000 tons of coal daily, and he states that 80 per cent. of this loss is preventable.

Practical Ventilation.[1]

[A paper read by Mr. MacD. Dexter, at the April Meeting of the Southern Gas Association.]

There has been an awakening all over the world, on subjects relating to hygiene, and matters relating to personal health and efficiency. Much is being written on the subject of out-door sleeping, pure air and ventilation. Legislators are framing laws on the subject; and gas men, while agreeing on the necessity of ventilation, do not admit that it is more necessary where gas is used than when not used. In fact, we claim that where there are means of ventilation, the tendency of gas is to improve conditions of air at the breathing level. Aside from our interest in the matter from the standpoint of promoting our industry, by considering proper ventilation a part of our service to the consumer, and enlightening the public as to the hygiene of gas, is not the subject of ventilation, from the standpoint of improved health, comfort, and business efficiency, of ourselves, our families, and those working for us, one worthy of our careful consideration?

1. This paper is slightly abridged.—Eds.

(*Continued on page* 326.)

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NOTICE TO ADVERTISERS.

New Advertisements and changes of copy therefor should be in hand Wednesday noon of week prior to date of issue.

NEW YORK, MONDAY, MAY 19, 1913.

[Official Notice.]

Ninth Annual Meeting, Southwestern Electrical and Gas Association.

Office of the Secretary,
Slaughter Building,
Dallas, Tex., April 5, 1913.

To the Members: The Ninth Annual Convention of the Southwestern Electrical and Gas Association will be held at Galveston, Tex., May 21, 22, 23 and 24—a 4-day meeting, instead of 3 days, as heretofore, the Association having so increased in scope and numbers as to necessitate more time for its proceedings. In addition, it has been found necessary to have "parallel sessions" for the gas members and the accountants, these to "parallel" regular sessions which are on subjects not interesting to those attending the gas and accounting sessions. One full session will be given up, as heretofore, to the "Supply Men," who have promised that it shall not be the *least* interesting session of the Convention. This will be followed, in the evening, with a "Rejuvenation" of the Sons of Jove, at which the National Deities will preside.

A large attendance is expected from the East and North, two special cars having already been reserved, from St. Louis to Dallas, where it is expected to "hitch on" enough Texas delegates to make a solid "Convention train" from there to Galveston.

The official and definite programme, with list of papers and topics for discussion will be published in a short time. Full information as to railroad rates and routes, hotel accommodation, exhibits, etc., may be obtained by addressing the Secretary, as above.

Yours truly, H. S. Cooper, Secretary.

[Special Editorial Correspondence.]

NINTH ANNUAL MEETING, IOWA DISTRICT GAS ASSOCIATION.—SECOND CHAPTER.

Hotel Burlington, Burlington, Ia., May 9th, 1913.

The good steamship "Morning Star," left Burlington yesterday morning, 9:30, bound for Keokuk, carrying as contingent the Iowa District Gas Association and its guests, to the number of 120. Perfect weather, an absence of bustle and hearty cordiality, brought the acme of satisfaction to the voyagers, some of whom were making their first trip over this district of the mighty waters of the Mississippi, and the plan of procedure gave rise to many an expression of comprehension as to why it was the recent meetings of the Michigan Association had been so well attended. The "Morning Star" was making smooth headway when the order for the second day's proceedings was called. The initial number was the Report of the Standing Committee on Manufacturing, which, in the unavoidable absence of Chairman E. W. Eustace, was read by Mr. H. E. Keller. The report turned out to be an exceedingly interesting resume of the progress made in difierent phases of industry during the year. Next in order was the paper by Mr. E. C. Weisgerber, in which that clever writer, under the set caption of "Recent Developments in Industrial Appliances," succinctly narrated and reviewed the latest progress and accomplishments in this ever-old, always-new field. Further, the paper's paragraphs included a clearly thought out series of emphases respecting the possibilities of this always multiplying fruitful field. Mr. Fenton P. Kelsey's paper on "Advertising," proved to be a methodical, wherefore practical, dissertation on the theory and way of resultful advertising in the gas industrial field However, in respect of this subject, it might be well here to remark that the best determiner, in regard to laying out an advertising scheme on industrial gas account, must be the man who knows his particular field personally; by which is meant that the practice on gas advertising account, say in Washington, D. C., as against the correct or resultful practice in Boston, Mass., would vary in wonderful degree. However, the Kelsey paper was a good one, as it naturally should have been; for Mr. Kelsey is far from being either tyro or novice in the varying fields of advertising. An adjournment for luncheon was taken. This satisfactorily disposed of, it was determined, owing to the pressure of time in which to accomplish the outlined inspection of the Mississippi River Power Company's great hydro-electric plant at Keokuk, to put over the balance of the technical doings until to-morrow. Arriving at Keokuk, shortly before 2 P.M., the visit of inspection to the Power Company's modern plant was made, with pleasure and instruction to every visitor. Our hospitable hosts subsequently enabled us to "do" rapidly growing Keokuk to the best advantage. Promptly, or "almost so," the "Morning Star" was again boarded; and surely a more pleasant evening could not have been enjoyed. In the first place an excellent banquet was served and its concomitant joys were ably abetted and attuned to eye and ear by the "Only Parker" from the Chair of President-Toastmaster, and on the floor by that living (not "live") wire, the handsome, heavy and humoristic Guitteau. The landing was successfully made.—V. I. G.

Hotel Burlington, May 9th, 1913.

The first session was held this morning, and although the proceedings were somewhat hurried, nothing on the agenda was neglected. The number that perhaps attracted the most attention, in that it surely dealt with a timely topic, was the paper submitted by Col. E. G. Pratt, on "The Oil Situation." It was prepared and presented in logical way, and its figures afforded ample proof, if further proof were needed, that the corporation which has the making of the rates regretted, as much as the purchasers regret it, that the selling prices had to be so sharply advanced. The inexorable laws governing production and consumption have certainly come into fast play respecting the use of enriching oils. Another excellent number was that by Mr. G. W. Clabaugh, whose masterly presentation of the subject of "The Welfare of the Employee" was simply a bright reflection and a true recounting of his lengthy, wide and varied experiences in this perplexing field. The paper, by Mr. W. H. Merritt, which proposed to narrate "Some Distribution Experiences," was put over until the meeting for next year, and the Report of the Standing Committee on Public Relations, owing to the much regretted absence of Mr. George McLean, was not available for consideration. The exact date (also place) of next meeting was not named, but the sessions will be held some time in May. To sum up, that which was done this year by the Iowa gas men, I am altogether safe in declaring that the meeting was in keeping with the spirit which animates all those identified with the surprising and stable growth of this lively member of the Union.—V. I. G.

TWELFTH CONVENTION, WISCONSIN GAS ASSOCIATION.

Hotel Pfister, Milwaukee, Wis., May 15, 1913.

The Twelfth Annual Convention of the Wisconsin Gas Association was held in the Hotel Pfister, Milwaukee, yesterday. The introductory session was called to order at 10 A.M. of the 14th, with President Wortendyke in the Chair, Secretary Harman occupying the recorder's desk. The weather was fair, the attendance was good, and the interest was positive and continued. President Wortendyke's annual message, while not a very lengthy one, nevertheless had sufficient point to cause the members to congratulate him over the practical value of some of his suggestions, especially in respect of upholding State supervision. In this connection, Mr. Halford E.

Erickson, of the Wisconsin Railroad Rate Commission, delivered a very well put together address on "Public Service Accounting." He surely is a marvel in respect of assembling accounts. Papers were read, respectively, by Messrs. G. F. Gregg and H. W. Easterly, whose clever analytical treatment of the St. Elmo Lewis paper, read at the Atlanta convention last year, was well worth while; and by C. A. Shannon, of Milwaukee, whose topic was "Automatic Water Gas Heaters." The latter, from his training, should surely be conversant with his subject. In the evening we enjoyed a royal banquet, which was served in the famous red room of the Pfister. And it was well served. Further, it was capably directed, in that the Toastmaster's Chair was sustaining the weight of no less a roaster than Col. E. G. Pratt, of Chicago. That the proceedings were of the order decorous may well be understood when it is known that two clergymen addressed the diners. However, this is a day of surprises, and it is hoped that in near future days a return to naturalness will be recorded.—DOUBLE H.

HOTEL PFISTER, May 16, 1913.

The second day's session of the convention was fraught with interest. The attendance kept increasing right up to noon of to-day, and roll call showed the presence of a scant hundred. The election for officers resulted in these choices:

President.—Ewald Haase, Milwaukee.
Vice-President.—Chris. Luebkeman, Manitowoc.
Secretary-Treasurer.—Henry Harman, Milwaukee.

The salary rate of the latter office was "increased" to $300. The proposition of a joint session with the Michigan Gas Association next June was referred to the Executive Committee, as was also the invitation respecting the proposed Pacific Coast Gas Congress. Another matter referred to that committee was the proposal to affiliate interests with the Wisconsin Electrical Association. These papers were read: "Efficiency Engineering in Small Coal Gas Works," by Mr. Peter J. Eastman—quite a well prepared paper this one; "National Advertising," by Mr. O'Donnell; "The Development of Small and Medium Sized Properties from Appropriate Standpoint," by Mr. J. A. Patten; and the "Development of the Use of Motor Trucks," by Mr. A. J. Cook, Philadelphia. Appropriate resolutions regarding the memory of the late Mr. David Douglas were adopted, and the time and place for next meeting were sent to the Executive Committee. The meeting was well managed, the sessions were well attended, and the interest was continuous.—DOUBLE H.

BRIEFLY TOLD.

OBITUARY NOTE, MR. JAMES CLARENCE MOBLEY.—With regret we report the death of Mr. James Clarence Mobley, in the residence of his daughter, 7 Trail avenue, Frederick, Md.. the morning of the 6th inst. Deceased came to Frederick in 1907, and there engaged in the plumbing business. He was born in Hagerstown, Md., December 24, 1850, and in 1875 was appointed Superintendent of the Westminster (Md.) Gas Light Company, serving as such for over 29 years. The funeral services were held in his late residence, the afternoon of the 8th inst., the Reverend U. S. G. Rupp officiating, and interment was made in Mt. Olivet Cemetery.

THE SUPREME COURT REVERSES A DECREE OF THE PUBLIC SERVICE COMMISSION, FIRST NEW YORK DISTRICT.—A decision of extraordinary interest was handed down by the Appellate Division of the New York Supreme Court, the morning of the 9th inst. It concerned the reviewing of a decree, made by the Public Service Commission, First New York District, in the case brought by certain complainants, against the Kings County Lighting Company, who urged as the basis of their contention that the Company's selling rate ($1.10 per 1,000 cubic feet) was excessive, and that the ruling rate (80 cents) in the thickly settled section of the Borough of Brooklyn would be a fair one. The district supplied by the Kings County Lighting Company is in the southern extremity of Brooklyn, or that portion bounded by the Narrows, Fort Hamilton, Coney Island Creek, and a considerable section of the old township of New Utrecht to the north and to Flatbush on the northeast. Up to within 8 years ago, possibly 30 per cent. of this area was in farmers' plots. Its development as a dwelling and business location went on with remarkable rapidity, but the area was large, and rows of houses were strung along, just as soon as streets were laid, without even sewerage, water supply or paving provision having been made. This rapid and altogether irregular growth taxed the resources, facilities and capital of the proprietors of the Kings County Lighting Company to the utmost, and indeed frequently the Company was stalled in its efforts on expansion account. However, many of the residents, knowing that right on their boundary lines, even at times on opposite street sides marking the boundaries of the respective Companies, other residents were getting their gas supply for 80 cents, whereas those on the one side were paying $1.10 therefor. The demurring to this eventually became so persistent that the complaint was made, hearings were held, and the 80-cent discussion was finally promulgated. While we have not received the full text of the decision, a summary thereof shows that the Appellate Division of the Supreme Court has declared that the 80-cent rate order is neither just nor fair to the Company, in that in determining such the Commission arbitrarily valued its property at $2,480,100, and then decided that 7½ per cent. thereon would be a fair return. Meanwhile the Company's contention, sustained by the testimony of competent experts, was that its property had been undervalued by at least $2,000,000. While the Court does not admit that that sum was really in undervaluation, it does unqualifiedly assert that the contention that the Commission had no right to deduct nearly $500,000 from the valuation of the plant because of depreciation, was correct; and so because the Company, insisting that it was entitled to a return on the full 1 00 per cent. of service value of its equipment, had shown by unimpeachable testimony in evidence that the efficiency of the plant was unimpaired. In clinching the position of the Company and sustaining the attitude of its counsel, the Court further remarks, in a very unmistakable sort of way, that the Commission would have been well within right and reason had it consented to the compromise rate schedule submitted by the Company prior to the hearing of the case. That schedule conceded a rate of $1 per 1,000, in 1912, or at the institution of the proceedings, a further concession (5 cents per 1,000) to be made at the beginning of 1913. The Appellate Division remits the case to the Commission with direction to further amend the rate in accordance with the suggestions contained in the decision.

A MODERN ALLADDIN.—The Evansville (Ind.) Gas and Electric Light Company offers to take all the old arc lamps in that city and give new gas lamps in exchange for them. The following is a part of its announcement: "For 30 days we will accept as part payment on our house piping proposition your old oil lamps. At the present price of gas you cannot afford to use oil and put up with the dirt, grease, muss, smoky chimneys and poor light. We offer to pipe your house for gas (all pipes concealed) and install neat, modern gas fixtures with Bray burners and glassware, and one Reflex light, at the following prices: 4 rooms complete, for $13.10; 5 rooms complete, for $17.05; larger house in proportion. We give you 8 months to pay for it, and we will also buy your old oil lamps."

PIPING REGULATIONS.—An informal conference was recently held, in the offices of the Massachusetts Board of Gas and Electric Light Commissioners, between the Commissioners, Mr. Francis H. Dewey (representing the Worcester Gas Light Company), and Messrs. J. F. Byrne, Edward Scanlon, Michael Guthrie, John J. Bussier and Stanley Minot, representing the Master Gasfitters. The conference came about through the claim put forth by Represe tative John C. Mahoney, for the "Masters" that the regulations inforced by the Worcester Gas Light Company, as to the piping of houses for gas supply, were unnecessarily strict. The specific case of the house piping in a tenement owned by Jas. G. Halpin was cited, in which instance the Company refused to serve gas on the grounds that its piping regulations had not been followed. The Company contended that the hazards involved called for the exercise of even greater strictures in respect of the regulations laid down. The matter was taken under advisement.

GAS AND ELECTRICITY AS VENTILATING AGENTS.—There was an amusing incident at the closing lecture in connection with the Doncaster Health Week. Professor Vivian B. Lewes had been lecturing upon "Air and Smoke in Their Relation to Health;" and discussion followed, in three-minute speeches. Those who spoke included Mr. E. S. Rayner, the Electricity Engineer to the Corporation, who said the principal function of his department was to diminish the smoke nuisance. Pointing to the electric light in the hall and an electric stove on the platform, he claimed that they were vastly superior to gas, and did not give off any fumes. Replying to the discussion, Professor Lewes said Mr. Rayner had "put his foot in it." He had told them he had a light which because it gave off no fumes was much more healthy than gas. He (Professor Lewes) spoke with considerable weight upon this question, because he had spent years in experimenting upon it. If they took a dwelling room lighted by electricity and another lighted by gas, they would find that the air in the breathing space was infinitely purer in the latter than in the former. And why? Because electricity gave off nothing. When they were burning gas, it set up heat currents which caused movements of the air, and were the greatest factor for health, because gas burnt off and killed the germs in the air. It left the charred remains of those germs as a brown patch over the gas burner, and so marked the work it had been doing.

(*Continued from page* 323.)

This paper will consider the question of ventilation from a practical standpoint, principally in connection with building construction, and will, of necessity, treat the subject in an elementary way. A building hot in summer, means a building without adequate ventilation. It would seem that here in the South, types of building construction would have been developed which would be radically different from those of a cooler climate, and that the rest of the country could look to us for the best construction, for summer cottages. But have we anything here, even in colonial, anti-bellum or modern houses, anything especially different from other parts of the country, unless it is generally higher ceilings and lack of that construction necessary for colder winter conditions. Our modern buildings are not the equal of the anti-bellum types for summer, and this is due partly to economic conditions. The tendency in building construction is toward the utilization of all available space. The old houses had large halls, opening at both ends and often two halls crossed each other; thus there was a free circulation of air whenever there was a breeze. The modern builder considers the cost of large halls and the cost of heating them, and bathrooms, closets, or hall bedrooms are placed across the ends of the halls. With the present cost of real estate, and building material, economy of space will continue to be practiced; hence the greater need for ventilation facilities. Twenty-five years living in a house with ceilings nearly 14 feet high, has shown that high ceilings alone do not make a cool house. But can we learn much from the old Southern types of building, or even from those in use in tropical countries? We have got to deal with the subject under the guidance of modern knowledge. The fear of malaria in night air was universal until it was conclusively demonstrated that it is caused solely by bite of a certain species of mosquito. The general acceptance by the public of the teachings of physicians as to the curative and tonic effects of open air living and sleeping, is also a matter of comparatively recent times. Night air is, if anything, more healthy than day air, because the falling dews and cessation of traffic and smoke production, remove dust from the air. Again, we all know the fight being waged against the white plague. Even in Columbus, there is hardly a new house built without sleeping porches. They are being added to old houses all over the country, whether the occupants have pulmonary troubles or not. To show how slowly ancient ideas are displaced, you will doubtless be surprised to know that it was demonstrated to the medical world in 1859 that the open air treatment was beneficial to consumption and pulmonary diseases. Physicians gradually learned, but it took 40 to 50 years for the public to become convinced. We have observed that often those who were not afraid of night air close up the houses in the morning it being supposed that they would remain cool longer. This is only partly true. Temperature out doors, as shown by a thermometer, in the sun, or in a position to receive radiant heat, is not the temperature of the air.

The subject of ventilation is receiving more attention than ever before. Scientists are making experiments the world over; but even yet the practice is in its infancy. There are all kinds of fresh air cranks and all kinds of ventilation and heating experts. The student of ventilation, who at first thinks from the very simplicity of the proposition that he knows all about it, will soon find that the more he reads, the less he knows. A lot of the evidence is circumstantial; for instance, it is not known why open air sleeping is beneficial, and while air is necessary for breathing, the beneficial effects of air on the skin, the effect of temperature and humidity play equally as important a part in the promotion of health and efficiency, and that vitality which enables us to maintain health and develop resisting powers against disease. Pulmonary trouble is only one of the diseases treated with fresh air. Tuberculosis of other organs is cured by the same means, as well as nervous disorders, stomach troubles, and many other maladies. Conditions are not the same indoors and out, even where chemical analyses show the air to be the same. It is not known what constitutes good air or bad air. Oxygen we know is necessary, but there must be something else and some have thought that it is ozone. The scientists have never been able to locate any toxic poison in bad air. In reading on the subject, it is well to consider the source of the information, and especially whether opinions given are according to the latest developments. Many statements made a few years ago are now known to be wrong, and much general information in the mind of the public is derived from sources of information now out of date.

Among the papers read before Gas Associations is one by T. D. Miller, before the Western Gas Association in 1900, and one by James Ferrier, before the same Association in 1901. Also the Report of the Committee on Hygiene, of this Association, presented in 1912 at the Jacksonville meeting. My interest in the subject began in 1901, as I had the pleasure of assisting Mr. Ferrier in his experiments. The most interesting document of recent years is the report made by Prof. S. Rideal, to the Royal Sanitary Institute in 1908, on "The Relative Hygienic Values of Gas and Electric Lighting." While some publicity has been given this report through the Gas Journals and in a booklet gotten out by the Welsbach Company, the facts mentioned are sufficiently interesting, and are of such importance as to permit of repetition, even though some of the facts are common knowledge among us.

The physiological data collected was numerous and thorough, and covered the observations of the

Frequency of pulse.
Frequency of respiration.
Arterial blood pressures.
Variation in the number of blood corpuscles.
Body temperatures.
Body weights.
Mental fatigue.
Time reaction, mind and muscle.
Eye fatigue (differentiated).
Impressions on senses, etc.

The experiments were made in a room approximately 16 × 30 feet, by 10 feet 4 inches high; this room was later divided into two rooms approximately 15 × 16 feet, by 10 feet 4 inches. The comparisons were between incandescent gas lights and carbon filament electric light of equal illuminating power, and the following summary covers the result of these experiments:

1. The whitewash on the walls of the room was able to absorb all the sulphur products of the gas burning for a period much beyond the investigation; the power would not be exhausted for 25 years.

2. The gas and electric burners and supply were arranged to be of normal type, with an ordinary good and equal illumination. The experiments were alternated from room to room, in order to neutralize any difference there might be in the characteristics of the two rooms; and in order to accentuate any effects, the ventilation was mostly restricted to an average of 2,000 cubic feet per hour.

3. The changes in the air of the room by the human contributions far exceed those by either illuminant.

4. Carbonic acid *per se*, in quantities up to 50 parts per 10,000, even when of respiratory origin, is not responsible for any physiological effects.

5. Although gas consumption originally develops more heat than electricity, it was found that the final result was equalized by the following:

(a) The gas burners gave rise to stronger air currents and invariably produced a more active ventilation and diffusion of air than electric light; hence, with the products of the gas burning, the exhalations from the persons present were more rapidly removed.

(b) The ascending currents of air from the gas lights on reaching the ceiling rapidly parted with their heat, which was conducted away by the rafters and joists.

(c) The electric lamps really produced more heat than is commonly credited to them. This seems to be the explanation of the unexpected result that the average temperature of the rooms was practically the same under either illuminant, and that the electric light did not show the superiority in coolness usually claimed.

6. The relative humidity of the air was 70 to 75 per cent. during the experiments, and was, therefore, such as the best authorities have laid down as most agreeable. On the score of humidity the use of either illuminant is, therefore, consistent with correct hygienic conditions.

7. Determinations of the organic matter in the air of the rooms showed that:

(a) The amount was very small and required for oxidation 4 to 18 parts by weight per million volumes of air.

(b) It increased in quantity in 3 hours in an electrically-lit room in which persons were present; therefore it was, for the most part, a respiratory product.

(c) Nineteen hours' gas burning in a room without occupants also gave fairly constant and comparatively high values.

(d) There were thus two kinds of organic matter parallel to the two kinds of carbonic acid, from respiration and combustion.

(e) A great part is due to organic dust.

(f) The rise in the course of an evening was less with gas than with electric light, probably because the organic matter produced by persons is partially destroyed by the gas flame.

8. That no appreciable amount of unburnt gas was present in the rooms during the investigation was proved by delicate tests for carbon monoxide. Only minute traces were found in no case reaching .01 parts per 10,000. In order to produce the physiological effects of a large leakage, three of the subjects remained in one room while 8.8 cubic feet of gas per hour was intentionally escaping, an exces-

sive amount. The symptoms were observed and the recovery. The inference from the experiment is that in any quantity of gas likely to escape from an ordinary leakage there is no fear of any immediate danger to health.

9. The bacterial contents of the air of the rooms were less with gas than with electricity, owing to (a) cremation of the organisms in the gas flames; (b) sterilizing effect of the sulphur acids from the gas; (c) increased condensation of the surface removing organisms, together with sulphur products. As a consequence the condensed moisture under electric light contained a number of living organisms, while that under gas was sterile.

10. As a rule the pulse rate fell in the interval between the beginning and the end of the experiments, and a greater fall occurred after the room was divided, which was independent of the source of light. All the four series were almost identical at the end of the evening run, and although a slightly lower rate was observed in both periods under the electric light, the figures, as a whole, prove that the difference in the mode of lighting has no influence on the rate of the pulse.

11. Respiration frequency; the change in environment due to the altered condition of ventilation and density of population occasioned by the division of the room, caused a greater difference in the respiratory act than change in the mode of lighting.

12. There was an apparent increase in the difference of the blood pressures in the undivided room under gas, but after the room was divided the results obtained under the two lights showed no marked difference on haemanometric readings.

13. Sphygmographic tracings and blood pressure determinations indicated generally a slight rise of arterial tone under both kinds of light, but there was more general improvement under gas than under electricity.

14. There is no physiological difference between the two lights affecting the body temperature, although this factor is very sensitive to slight alterations in the temperature and humidity of the room.

15. In changes of body weight, the influence of the two illuminants was too small to affect the result either way.

16. Calculations set to 10 persons at the beginning and end of 13 evenings to ascertain if any mental fatigue was occasioned by either mode of illumination, showed that, owing to the subject being comparatively at rest in the interval, a general improvement occurred, electricity giving the greater average gain in speed and also in accuracy. The results distinctly proved that the evening's rest had done more good on the whole under electric light than under gas, but there were more cases under gas in which no change took place.

17. Tests on 9 persons on 5 different occasions after the gas and electric lights had been burning for 3 to 12 hours, showed that neither had affected the air sufficiently to make any certain difference to the sense of smell.

18. With 8 subjects on each of 9 evenings, there was a very slight slowing down of the velocity of transmission of nerve force at the close of the 3 hours, to a like degree under gas and electric light.

19. In the opthalmic experiments:

(a.) The sensitiveness of the eye to light as measured in the perception test is diminished very markedly after exposure to electric light, while no corresponding effect is noticeable after the eye has been subjected to the gas light.

(b.) The power of co-ordinating and using the motor muscles of the eyeball recorded in the orbicular muscle tests was diminished to a greater extent after subjection to electric than to gas light.

(c.) It was found that the ciliary muscles of the eye are more accommodative after 3 hours' exposure to a 50-candle power electric light.

(d.) The acuity of vision measured by the retinal test again shows that the optic nerve or center was more susceptible in the case of gas illumination.

(e.) The total advantage accruing to the individuals examined shows that there were only two small gains under electric light, while there were eight considerable gains under gas light. Adding up all the advantages gained by the ten subjects, they stand at 79.3 to 3.5, leaving a difference in favor of gas of 75.8 units, or an average gain of 7.58 units per man.

General.—The burning of gas for lighting consumes oxygen and is accompanied by the production of considerable quantities of carbonic acid, water vapor, and other substances, and of twice as much heat as results from an equal illumination by electricity. If the gas burnt in an air-tight box, with sides of some non-conducting materials, the oxygen would be quickly exhausted, and the products would accumulate. These conditions are not even distantly approached in any actual room, since there is always an active and continuous interchange of air, and heat is freely conducted and radiated through the walls, windows and ceiling. By their construction, the rooms used for these experiments were more nearly air-tight than any ordinary living room is likely to be, the rate of ventilation through the walls being only one-half of that noted by Pettenkofer. Notwithstanding this, and the special precautions taken to prevent the ingress of further air, the composition of the air under gas illumination showed no marked difference from that under electricity, and the condition of the room as regards heat was practically the same under both illuminants.

With natural ventilation the proportion of carbonic acid in the air was practically identical for both illuminants. The ventilating effect of the gas burners thus proved competent to carry off the whole of their products, or an equivalent amount of the products of respiration. It is, therefore, not surprising that the search for the physiological effects of lighting by gas has been in the main fruitless.

Fifteen men were subjected on more than 50 occasions to some 6,000 tests of the kind best calculated to detect any falling off in condition as might be expected under either mode of illumination. The results of these tests have been carefully examined and averaged, and, with a few exceptions, they fail to disclose any measureable difference between one mode of lighting and the other. Not only so, but in no case do they show any deviation from any normal conditions. It is not merely that the changes noted were well within the limits of accommodation. That would be a very poor answer to the question propounded, for it would obviously be unsatisfactory that a system of lighting should trench, no matter how slightly, upon that power of accommodation on which the body depends to safeguard it in the presence of adverse circumstances. Not only were the limits of accommodation never exceeded, but they were in no case even distantly approached, and the conditions which the physiological tests disclosed were in all cases entirely satisfactory. The differences found between the two lights were so small as to be absolutely devoid of any hygienic significance; they were, in fact, much less than those that are constantly produced in healthy subjects by slight changes in their condition or environment.

Not less important than the negative indication of the statistical results is the fact that 15 men, after a day's work, were confined for several hours each evening in crowded and scantily ventilated rooms in which the products of gas combustion or the heat from electric lighting were allowed to accumulate to an extent which would hardly be possible in an ordinary living room, that they were under continuous medical observation, and that in no case was any adverse influence of any kind exerted by the lights or their products. It is true that in the arithmetical tests the mistakes at the end of the evening exceeded those at the beginning, but from a physiological point of view the gain in speed may fairly be regarded as offsetting the loss in accuracy. It was also found by the very delicate optical tests that some slight falling off in visual power took place under the electric light. Any trouble from this cause could, however, be effectually guarded against by adopting an arrangement of lights suitable for the use to which the room is to be put.

There doubtless are persons so peculiarly constituted as to find one light or other objectionable, or even to be unable to tolerate and artificial light whatever. Such cases belong to the domain of pathology rather than that of hygiene. On a review of the whole of the facts collected, it may be said, without reservation, that there is nothing in either mode of lighting which is incompatible with the best hygienic conditions.

The main conclusions may be, therefore, summed up as follows:

1. Owing to the better ventilation obtained by gas, the products of combustion are not found in the air in anything like the proportion which might be expected, the temperature and humidity in an occupied room being no greater than when the room is lit by electric light.

2. Carbonic acid has not the injurious effect which was formerly attributed to it, but considerable rises in the temperature and moisture content of a room, from whatever source, do have a prejudicial effect upon the occupants. Even under adverse conditions of ventilation purposely created for this injury, neither the temperature nor percentages of moisture in the room reached a point at which any such effect could be detected by any of the recognized physiological tests.

3. It has been established that the products heat, carbonic acid and moisture, so far as they modify the health of the occupants of a room, are derived from the inmates more than from the illuminant, and that a room of moderate size can be sufficiently lighted by gas without sensibly affecting the amount of these three factors.

4. Whilst undoubtedly, it is important to ensure adequate ventilation in domestic rooms, this, with present methods of construction, is better ensured the smaller the room. The problem of securing sufficient ventilation in public rooms of a larger size has been outside the scope of this inquiry.

5. The medical conclusions are in accord with those arrived at from the chemical and physical data, and also demonstrate that the choice between the two systems of lighting does not depend upon hygienic conditions.

These facts from an unbiased authority establish the claims of

gas from a hygienic standpoint for lighting; the principles of which hold in other uses of gas, except where the proportion of gas used, or the number of occupants in proportion to the cubical contents of the room, is relatively larger.

The subject of heating with gas is one which should be covered with a separate paper. Gas heating is desirable because of its convenience, readiness to serve, cleanliness, ease of regulation and economy through ease of control, especially for intermittent use of heat on short notice. On account of the absence of extreme cold, gas for heating is especially applicable to weather conditions in the South. Heaters without flue connections should be recommended only for intermittent use unless there is some form of opening above the breathing level. Some authorities maintain that the ideal heat is radiant heat, with fresh air, at not too high a temperature, supplied near the floor and the exit near the ceiling. This is nature's process. We all know the pleasant effect of the radiant heat of the sun even when the temperature of the air is fairly cold. With radiant heat, much cooler air can be admitted with comfort than when the heating is solely by heated air. This by means other than gas could be obtained by radiators and by mechanical draft through a number of openings. To a certain extent does not gas heating approach this? We have radiant heat with the products of combustion so highly heated as to rise upward out of the breathing level, and out of the room, provided there are sufficient openings. Cool, fresh air is drawn in through cracks and crevices in many parts of the room.

The need of ventilation should not be dependent on the use of gas. The arguments in favor of health and comfort are sufficient in themselves. The use of gas in a room provided with ventilation tends to improve the ventilation. For health and comfort, the living room and the bedrooms are not the only ones to be considered. Take the bathrooms for instance. Ventilation is desirable here because it usually contains a toilet and because the humidity is likely to be high. These are sufficient arguments without considering the fact that a gas heater will probably be used. The question of bathroom heating with the usual type of gas heaters is no different from that of any other room, except that, in order to obtain quick heat, the capacities are usually greater than ordinarily necessary, and it is evident that some ventilation is necessary. It is generally admitted, that owing to the cooling effect on flame temperatures in water heaters, that all of these, and especially those in small bathrooms, should be connected with flues.

One important part of our houses that is usually given the least attention, from a ventilation standpoint, is the kitchen. Its location should be such as to admit plenty of sunshine. The ratio of window openings to cubical contents should be as high as any room in the house. But in many houses, and especially those of the ordinary types, it is simply a room with one or more windows, and this usually of small stock size. We have the results of Dr. Rideal's experiments, covering the use of gas for lighting; but we must remember that the amount of gas used is small compared with that used in a gas stove. In some kitchens a thermometer would be a poor witness to our claims of a "cool kitchen" when cooking with gas. There is every hygienic ground for adequate ventilation of a kitchen without the necessity of considering the means of cooking; and it certainly behooves us to disseminate any knowledge and information we have along these lines. While it may not be convenient in every house to have flue openings in the ceiling, there is no reason why the window areas cannot be large and extend to the ceilings. Think of the heat held and radiated downward by ceilings. They are heated by the hot air which rises and has no outlet, if there are no openings, and the windows do not reach the ceiling. Consider the area of ceiling and the fact that the temperature may be 5 or 10° higher than the rest of the room. The radiating effect of this large area is equivalent to a smaller area raised a great number of degrees. The only difference is one of position; 100 square reet raised 10° is comparable to 10 square feet raised 100°.

There are three methods of ventilation: That produced by heat, or rather differences in temperature of two bodies of air; that caused by the wind; and mechanical or power ventilation. Since we cannot control the wind and are likely to have none on the hottest days, we need not consider this means except in designing houses to endeavor to place openings or hallways so as to have cross draughts or through openings, so as to obtain circulation and renewing of air as well as the cooling effect of moving air.

Heat expands air, lowering its specific gravity, and the result is a tendency to rise, not due to any vacuum effect, but to the force of gravity on air of a relatively lower temperature, which is heavier. As it is said that water seeks its own level, so it might be said that the tendency of air is to seek its own level. Heated air will rise toward air of the same specific gravity, but in so doing loses its heat by convection and conduction. Air expands 1/460 of its volume for each degree of rise in temperature. Roughly, 5° rise increases the volume 1 per cent. The specific heat of air is .23571, that of water being 1.000. Thus, 1 B.T.U., which is the heat required to raise 1 pound of water 1°, will raise about 4¼ pounds of air 1°; 4¼ pounds of air at 80° F. is about 58 feet. But while it takes a large volume of air to absorb 1 B.T.U., it is very easy for the air to give up this heat to a small body of another substance of a higher specific heat. The total heat added to air is not therefore, always available for ventilating purposes, since some is absorbed by walls and ceilings or by the wall of a flue.

We gas men, accustomed to figure flow in pipes where we know the size of the pipe and the force due to pressure, can get some idea of the difficulty of moving air by heat alone, when we consider that a chimney containing air 390° above the surrounding air, and 120 feet high, will have a vacuum equivalent to less than ½ inch of water column. It is hardly possible to figure the amount of air which will be moved by an ordinary galvanized iron ventilator, by means of formulas for flow in gas pipes. Yet how common is the belief that if a ventilator is put in a ceiling or in a roof that that is ventilation—because "hot air rises" and that it will all go out through that opening just because it is in the ceiling or the roof. But when we consider that air has weight and that it will not move unless there is some force to move it, and when this energy is due, as explained, to the force of heat of a few degrees difference, the force is almost negligible and cannot be used to any advantage unless there be large areas or great height. Air will often give up its heat by conduction to the ceilings before it has time to be forced through relatively small openings when impelled by but few degrees of heat. A small ventilator may be effective in winter when the room is heated, but it is almost negligible in summer. The conditions in summer when it is hotter in a room than outdoors can be due to a number of causes, such as the sun shining on a side of the room, the heat given off by the persons in the room, the heat from the use of gas, the heat due to the air and walls heated during the day. In figuring for ventilation remember we must use the temperature of outdoor air and not the temperature of objects affected by radiant heat from the sun, when calculating difference in temperature indoors and out. The upper stratas of air are naturally cold, since air receives but little heat by radiation from the sun or from the earth by convection. This heated air rises and in contact with cooler air gives up its heat. Thus nature provides a constant circulation of the air surrounding the earth and the temperature of the air we live in is more agreeable than the cold of the upper stratas.

If air in a closed room is heated, it tends to rise; its greatest pressure is nearest the ceiling, its least pressure is nearest the floor. At a point midway between the floor and the ceiling its pressure is the same as the outside air. This point is called the neutral zone because here, if there be an opening in the wall, there is no tendency of the air to pass in or out. This was first proved experimentally by the construction of a cubical frame covered with paper. Placed over a lighted lamp, the paper around the upper half tended to bulge out, the lower half in, and around its center, neither in nor out. Hot air balloons are therefore made with their largest volume above the neutral zone. Of course everyone knows that hot air rises and cold air falls, but few know of the effect of this neutral zone, when no breeze is stirring, or how slight is the effect of raising the lower sash, since nearly always a part of the opening is within the neutral zone. Pulling down the upper sash and then raising the lower sash, of course, improves matters, but through laziness or ignorance, or a desire to feel the breezes, advantage is not usually taken of this principle.

The advantage of height of a flue, or vertical distance between two ventilations is readily seen, since with a given difference in temperatures the difference in weights of two columns of air or the unit pressure, is a function of their heights. This is particularly true for window ventilation. For flues the question of friction and radiation losses must be considered.

For maximum ventilation and for summer comfort ceilings should be high, but never higher than window openings, or else there should be provision in the ceiling for removal of heated air. The necessity of height for natural ventilation is, of course, less for a small room, say a bed room, than for a store or hall or auditorium. A bed room of a height of 9 or 10 feet may be well ventilated, when a long store with this height and openings only at each end would be oppressive, since the ventilation force due to height would not be sufficient to move the air from the center of the store to the ends. For the ventilation of a 2 story store, the advantage of height can be had by an opening connecting the 2 floors near the center, for the tendency of fresh air to enter is at the floor of the first story and for exit at the ceiling of the upper story. When the building consists of 3 connected stories then the same principle prevails, the middle story laying in the neutral zone. Thus in large buildings where the different floors are connected by stairways or open elevator shafts, the position of the neutral zone is near the middle floor. Transoms over the doors on the lower floors serve to ventilate the rooms, but if transoms are open on the floors above the neutral zone, the tendency is for the air from the halls to pass through the transoms into the rooms. Observation will show in how few modern buildings this fact is considered.

The most efficient window ventilation is when the opening is from the floor to ceiling and windows on opposite sides of a room, but this is as a rule impracticable. From a ventilation standpoint, windows should be hinged so as to get 100 per cent. air opening and not 50 per cent., as with a double sash window. Where casement or hinged windows are not practicable the next best window is of the sliding sash type in three sections instead of two, the middle sash being stationary, the bottom one to be raised and the top one to be lowered. This type is often used in factory construction. I observed a cotton mill built only last summer, however, where this condition was reversed and only the middle sash openable. I could not ascertain whether this was due to ignorance or to an effort to increase humidity by restricting ventilation. The use of steel and re-inforced concrete for factory construction, on account of their greater strength, permit of greater window area, and the use of steel sash and mechanical means for opening them allow new standards of industrial hygiene.

The public needs to be better educated on the subject. For instance, how many changes are being made in store fronts and in how few cases are architects engaged. Any contractor can put in a new front, and partly to economize in plate glass the upper part of the window is ribbed or translucent glass and seldom movable like a transom; the back door and windows are usually small, thus the upper third

or half of the store becomes a pocket for the accumulation of hot and bad air and the electric contractor puts in ceiling fans to blow this air down. How is this for a place to burn gas? Is it not in such stores as this that the bad impression of the heat of gas is obtained?

We give our customers the results of our knowledge in matters pertaining to illumination engineering. Why should not a ventilation engineer be equally necessary in the organization of an up-to-date commercial department? And it would seem that the electric companies should specialize in this direction. It is true they sell fans, but it is usually left to the customer to work out the method of their use, and in many cases it is done in the most illogical way. Gas men should make a study of mechanical ventilation for it is undoubtedly the cheapest and most effective method. The public know that it is cool in the breeze of an electric fan, but how many know why? The actual temperature of air in front of an electric fan is higher than behind it, due to the heat of the motor and to the tendency to compress the air. The cooling effect is due to heat given up by the body upon evaporation of perspiration, and to the movement of the hot air envelope surrounding the body. But often the air is taken from the upper stratas and blown down, or in the case of desk fans, air is blown from one hot corner into another, and the air and dust is simply stirred up, instead of considering some consistent plan to move the air in one direction and out of the room. In so planning, consideration should be given to the direction of prevailing winds and not to try and move air in directions contrary to them.

Our display room has been a problem for ventilation, on account of the length, low ceiling and the number of electric and gas lights. Owing to the larger number of electric lights burned in summer the total heat added is about the same in both seasons. We have a transom fan over the back door blowing in and one over the front door blowing out, and other fans placed to blow in the same direction. Over the front door a 14-inch transom fan was used in an opening the size of the fan. With good results, we removed the whole transom which is about 3 by 4 feet and suspended the fan by leather straps, about 6 feet back in the room and directed toward the center of the opening. The object was not to take advantage of the larger opening for natural ventilation, but to take advantage of the frictional effect of the column of air projected by the fan. An ordinary fan projects air in a cylinder the diameter of the fan blades; its conical effect is due to resistance of the still air it is directed against, and to frictional effect of air in contact with the projected body of air. The tendency is to pick up air and carry it along, in the same way that a jet of gas in a bunsen burner carries air along with it. By supporting the fan on straps the noise is lessened, and considerably more air is moved out of the room by friction, than would pass through the fan when confined in an opening the size of the fan. This principle can be used to good advantage where an electric fan is used to raise air in a flue or any ventilating opening. I made a similar experiment in my bed room. This is a down stairs room having two windows on one side and one on the other; a door with a transom over it opening into the hall. A small electric fan was placed in the room blowing through the transom, thus bringing fresh air through the windows and across the room. It was found by observation with tobacco smoke, as well as by results in coolness in the room, that more air was moved when the fan was moved back into the room until the volume of air projected by the fan nearly filled the opening. This fan was run 24 hours a day from April to November, and in the winter at night only. The effect was outdoor air for sleeping, under control, and on account of the area of the cross section of the room the velocity of the moving air was such that no ill effects from draughts were felt. For several years previous my bed room was upstairs with 13½ feet ceiling and windows fully 2½ feet from the ceiling. In this room, a 3 inch flue was put over the top of the Welsbach burner in the center of the room, terminating just above the ceiling into a 6 inch flue extending several feet into the attic. The ventilation effect was noticeable and the removal of air from near the ceiling, proven by tobacco smoke.

Gas can thus be used to advantage to remove its own products of combustion, its own heat and at the same time assists in ventilating, and where the object is lighting, every possible advantage should be taken of this effect.

It would seem that owing to the low specific heat of air, as burner consuming 5 feet of gas of 600 B. T. U. per foot would give enough heat to raise 17,400 feet (600 B. T. U. × 5 feet × 58 cubic feet at 80° F. + 10) 10°, that the ventilating effect of gas is tremendous. But it is not so great as it seems. This heat is distributed over an hour's time and a large part is absorbed by the walls. See Dr. Rideals tests to show how slightly gas heat effects room temperatures. Ten degress difference in temperature, even if the air is confined in a non-conducting flue say 10 feet high, will tend to cause a difference in pressure equivalent to but .0025 in water column.

It is well known that fresh air is as necessary to the skin and body to remove the emanations from the pores, and the excessive humidity which immediately surrounds the body unless the air is in motion, as to the lungs. In the day time the movement of our bodies and the porous clothing we wear help to accomplish this, but at night when under heavy cover, the humid air from under the cover finds its way out principally by breathing, and does it not seem logical that one of the benefits of outdoor sleeping is by reason of breezes removing this air before it is breathed? More matter is thrown off from the body of a sick person than that from one well. After a case of fever I made the experiment of connecting a tube from under the covers of a bed to the inlet of a small turbine electric fan. Why not in a hospital ward have a vacuum line around the room with connections at each bed, and so ventilate each bed and obtain the beneficial effect of fresh air on the body? A regulating valve could be placed at each bed so as to prevent lowering of body temperature. I am building a home in which some of these principles are utilized.

The house is frame, sheeted and weatherboarded, with building paper for insulation. The sub-floor extends across the studding to the sheeting, to make the openings between the studs dead air spaces. The weatherboards, rough side out, are finished with creosote shingle stain. The roof is covered with composition shingles approved by the fire underwriters and taking the same rate as tin or slate. The roof has three gables with slatted ventilators in each. The spaces between the roof rafters where they rest upon the edges of the house are left open for further air circulation. The overhang of gables and eaves is 3 feet, this for appearance as well as some protection from the sun's rays. Every room has an exposure on at least two sides, and the kitchen and two bed rooms have exposures and window openings on two opposite sides, and for this reason no outdoor sleeping room was considered necessary, although one small room is arranged for easy conversion into one. All windows are casements swinging out, with transoms over them, also swinging out, and the openings reach to the ceilings. Thus each room has at least four windows with 100 per cent. openings and is equivalent to eight double sash windows with a 50 per cent. opening. The adjusters permit of control of the casement sashes from within, without the necessity of raising the screen. It is, of course, necessary to screen the whole window opening, for screens so obstruct little breezes and so impede the natural tendency for hot air to get out that it is desirable to have as much screened area as possible. Triple sash windows, while lacking the opening, have the advantage that outside blinds are possible. In this house there will be no blinds, but over windows getting the hot sun, there are eaves or awnings. In many houses with double sash windows, people cling to roller shades. Very few of these can be raised to the top when a window is pulled down from the top. Such an opening with a shade over it is not very effective for ventilation.

The question of window drapery can be handled in a variety of ways, but the question of proper air circulation should have precedent over decorative effect. Whether the window height is designed to suit the ceilings, or *vice versa*, is immaterial, but 9 feet was selected as being suitable for this cottage. Higher ceilings means greater costs and higher operating expenses when it comes to heating.

Over the center gas lights are ventilators, of the ordinary Welsbach type, except that they are set flush with the ceiling so as to remove the hot air from the surface of the ceiling. They can be installed in any house where the gas drop is midway between two joists. For ventilating flue the space between the joists and vertical studding will be utilized. It is not expected that this will be of great effect, on account of the small amount of heat given by a gas light and the absorption of heat by the flue passages. But it will remove from the room the products of combustion and some heat.

Although two-story, with an open stairway, the window openings on the lower floor extend to the ceiling, because often a breeze will blow through a window and away from the stairway openings. Thus openings are desirable although near the neutral zone. Door openings are 6 feet 10 inches high with no transoms. This is especially important upstairs and between the kitchen and connecting rooms. There will be no beamed ceilings which make hot air pockets and make a room slow to cool off at night. The kitchen windows have no overhanging eaves on the east side so as to get the full hygienic effect of sunshine in the mornings. The windows on the west side open on a porch, which protects from the hotter afternoon sun. The kitchen sink and all plumbing fixtures are on the eastern side, so as to get sunshine and to be away from the cold northwest winds of winter. Over the gas stove in the kitchen is a flue opening extending up into the attic. The cross section of this opening is 12 × 60 inches or 5 square feet, the space between a center chimney and the wall, which would ordinarily be used as a closet, is utilized for this purpose. A hood will be built over the stove extending into this flue space, but not entirely filling it, the idea being to use the aspirating effect of heat from the gas stove to remove other heat. There will be a damper to prevent over-draught in winter.

The Vanderbilt East River Homes in New York, which are considered model in a great many respects, have mechanical ventilation over each gas stove. The only other means of ventilation provided is by exceptionally large windows, which are the 3-sash type, reaching to the ceiling and without extra blinds.

The old type of Southern kitchens was detached from the main dwelling, possibly on account of heat from the old stoves and because of the colored cook. Now it is desirable to have the kitchen as accessible as possible, because one often has to do their own cooking, and it is desirable to have it near if only for supervision. The gas stove, to a great extent, lessens the heat. It only remains to have further refinements in ventilation.

The main stairway is from the living room to a hall where access by doors is had to the bathroom, bedrooms and upstairs back porch. In the ceiling of this hall is a ventilator to the attic, 16 inches by 5 feet, to remove the heated air from the living room and dining room downstairs, which are divided only by a grilled partition. Heating will be by means of a large base burner in the living room, burning gas coke. This by radiant heat will also heat the diningroom; a hot air flue from the stove leads to a register in the bedroom above. A certain amount of heat will go up the stairway and heat the other bedrooms through open doors, so that, except in the coldest weather, no other means of heating will be necessary. Flue openings have been provided in the other bedrooms, so that when necessary small coal stoves can be used or gas heat utilized.

The light will be gas with provision for pneumatic lighting and extinguishing by push buttons in the walls and concealed sockets in the walls for connecting tubing for portable lights or heaters. The house will be wired and fans and other appliances can be used, but this house is to demonstrate that a house in the South with low ceilings and using gas exclusively can be cool and comfortable in the hottest summer.

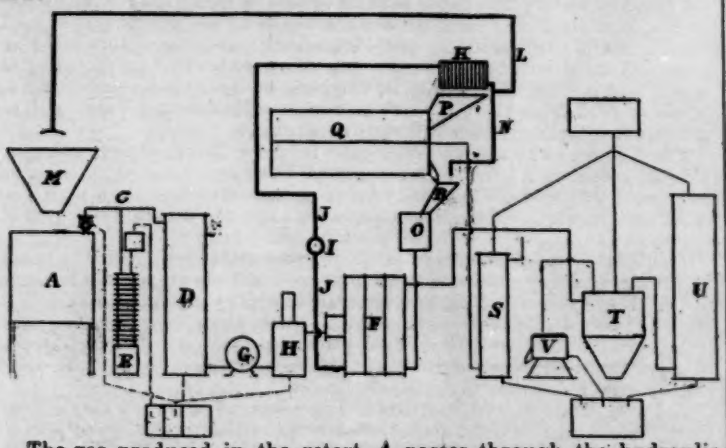
New Methods and Appliances.

CRUDE TAR FOR COOLING COAL GAS.—A patent has been issued in Germany covering the use of crude gas tar for cooling and washing crude coal gas. Herr A. Beuthner, Superintendent of the Brunswick Gas Works, in describing his invention, says, that while ordinarily the tar is taken direct to the tar well where it acquires the temperature of the ground, on account of its high specific heat it is more suitable than liquor for cooling crude gas, and, on account of its composition, it should be capable of effecting considerable purification of the gas. The hot summer of 1911 produced many naphthaline obstructions in the distributing system. Atmospheric condensers became ineffective, and while the duty of extracting the naphthaline was thrown upon the naphthaline washers, the high temperature of the gas entering the latter caused much liquor to be deposited in them. The liquor thus deposited interfered with the action of the oil in the washers. He then endeavored to cool the crude gas before it entered the atmospheric condenser by means of a finely divided stream of tar; and the result was better than he had anticipated. He used an annular condenser for the purpose of erecting on top of it a tank with a screened inlet for tar. The tar flowed from the tank on to a distributor in the top of the condenser, and thence fell in finely divided streams to the bottom of the condenser, up which the hot gas was passing in the reverse direction to the tar spray. Intimate contact between the latter and the gas was thus attained; and the sudden cooling of the crude gas produced in it a tar fog which, with the tar introduced, took from the gas almost all of the naphthaline, a great part of the carbon bisulphide, and some of the sulphuretted hydrogen. Most of the tar was extracted from the crude gas at the same time.

Before this tar condenser was introduced, from 6 oz. to 8 oz. of washing oil was used in the naphthaline washers per 1,000 cubic feet of gas dealt with, whereas after the tar condenser was used 2 oz. of washing oil sufficed. The effect of the tar treatment on the gas may be realized from the fact that the thick tar and naphthaline which had previously been deposited in the atmospheric condenser, tar extractor, and connections were removed in a short time by the gas which had passed through the tar condenser, and a slimy layer no longer formed on the surface of the water in the "Standard" washer, and obstruction of the wood bundles, with consequent back pressure, was thus avoided. With the arrangement adopted about a gallon of tar per minute is required to cool 1,000 cubic feet of gas from 122° to 90° F. The tar becomes thinner and more valuable as a result of its use in the tar condenser. A favorable effect was also observed on the illuminating power and calorific value of the gas treated.

REMOVAL OF H_2S FROM GAS.—A recent French patent, issued to Herr K. Burkheiser, covers a new method of purification. The process aims at increasing the activity of the chemical actions utilized, by the presence of alkali, using the ammonia in the gas as the intensifying reagent. In other words, the H_2S is removed immediately after the tar is extracted, and before the ammonia is eliminated.

The operations can be understood by referring to the diagram below.



The gas produced in the retort *A* passes through the hydraulic main *B* and the pipe *C* into the condenser *D*, where it is cooled. The ammoniacal liquor collected in the condenser is treated in the distilling column *E*, and put back into the gas before it reaches the purifier *F*. The exhauster *G* takes the gas, and pumps it through the tar extractor *H*, where the final traces of tar are removed. The gas then enters the purifier, which is a rotary one, of the cyanide scrubber type. The washing liquor, which contains the hydrated oxide of iron in suspension, is pumped from compartment to compartment to meet the gas, so that in the last compartment—viz., that which the gas first enters—the mass is nearly saturated with H_2S and the washing liquor is richest in sulphocyanic compounds. From this last compartment, the saturated mass is taken by the pump *I* through the pipe *J* into the filter press *K*, where the liquid is separated from the oxide. Part of the liquid is pumped through the pipe *L*, into the coal hopper *M*, where it slightly dampens the coal, and then is conveyed with it into the retort, where the sulphocyanic compounds are transformed into ammonia, and then re-enters the gas. The remainder of the liquid from the filter press and the water employed to wash the filtrate runs through pipes *N* into the tank *O*, furnished with an agitator. The remainder of the liquid passes through the passage *P* into the regenerator *Q*, where the oxide of iron is revivified with air until sulphur dioxide or trioxide is formed. The revivified materials flow out of the regenerator through the passage *R*, fall into the tank *O*, to be pumped, with the washing liquid from the filtration, into the rotary purifier *F*, there to resume their cycle. The sulphur dioxide formed in the regenerator is washed in the air scrubber *S*, and the ammonia in the gas in the saturator *T* and the ammonia scrubber *U*. The precipitated salt is removed from the lye by the hydro-extractor *V*.

Items of Interest
FROM VARIOUS LOCALITIES.

"JAMES DUBBELL and associates have been authorized by the California Railroad Commission to dispose of their gas properties in San Bernardino, Colton and Corona to the Citrus Belt Gas Company, of San Bernardino. The Dubbell combinati on asked the right to issue $812,000 in securities, but the Commission decided the Company might only assume $351,000 in outstanding bonds, and to the emitting of $200,000 in stock and $25,000 in notes.—D."

THE Citizens Gas Company, of Indianapolis (Ind.) through Secretary J. D. Forrest, announces the acquiring by it of 13 acres of land adjoining its present site. For the present the property will be used for storage purposes.

"THE Good Service Club, of the Galveston (Tex.) Gas Company, had a royally fine time of it last month, in the shape of an 'oyster fest' at 'John's; down the Island.' Virtually the complete membership of the Club took part; and, if a feast may be judged by its shells, this feast was most appetizing. The Club was organized not very long ago; but, even thus far, its influence for good in the matter of improving the general spirit of the body is marked.—WALTER."

WE are informed that the New Orleans (La.) Railway and Light Company is in the market for a holder up to retaining five million cubic feet. This, with other betterments that are projected on the works, will require at least $300,000 for their completion.

MR. FRANK X. BURNS, for some time in the service of the Central Hudson Gas and Electric Company, mainly in the Poughkeepsie (N. Y.) division of that corporation, has resigned in order to engage in business on his own account.

THE contract for the condensing and scrubbing plant, to be installed in the new plant for the Mohawk Gas Company, of Schenectady, N. Y., has been awarded to the Lloyd Construction Company, of Detroit, Mich. The plant is rated to a daily output capacity of 1,500,000 cubic feet, and it is calculated that the plant will be completed by October 10th.

ARTICLES of agreement have been filed in Trenton, N. J., incorporating the Mercer County Gas Company, of Hightstown, N. J., with George P. Dennis as the Agent. It is capitalized in $20,000, and its objects are: "To manufacture, supply, distribute and sell gas for illuminating and heating in the borough of Hightstown and the township of East Windsor." The chief stockholder is Henry Fry, of Pitman, N. J., and the other incorporators are: F. D. Moses, of Trenton; Geo. P. Dennis, Geo. E. Silas, John R. Shangle, John G. Scheible, C. E. Stutts, J. E. Allen, W. L. Wilbur, C. A. Dennis, and W. N. Cunningham.

NEXT Monday, B. W. Cummings, as solicitor, will apply to the Governor of Pennsylvania for a charter for a corporation to be legally known as the Nesquehoning Gas Company, the purpose of which is to manufacture and supply gas for *light only* to the residents of Mauch Chunk township, county of Carbon, Pa.

ACCORDING to a statement made by Controller John M. Walton, Philadelphia, Pa., the quantity of gas sold by the United Gas Improvement Company, for the first quarter of the year, amounted to 2,552,544,000 cubic feet.

MESSRS. FARSON, SON & CO., inform the holders that they have been notified by the Trustees of the Evansville (Ind.) Gas and Electric Light Company that 10 of the first mortgage 5's (payable in 1932) have been called for payment at 105 and interest, the call to be effective the 1st prox. The drawn bonds are numbered 18, 139, 319, 346, 547, 695, 753, 855, 1,101 and 1,130.

AT the annual election for Directors in the Cincinnati Gas and Electric Company, the following gentlemen were chosen: H. L. Brenneman, S. R. Bertron, J. T. Carew, Jerome D. Creed, Edward H. Ernst, George D. Eustis, J. B. Foraker, Jr., L. J. Hauck, M. E. Moch, C. H. Rowe and C. F. Windisch.

THE new gas rate (90 cents per 1,000 cubic feet) that, of course, formed a governing condition under which an addition of 25 years was made to the chartered life of the Clinton (Ia.) Gas and Electric Company, became effective the 1st inst.

MR. E. K. WILDE, the General Superintendent of the Sydney (Australia) Gas Company, is on a visit to the Pacific Coast. While stopping in San Francisco, the fact that Wilde is an employer of labor on a large scale being well known, he was interviewed on the subject of employer and employee in Australia, by a reporter of the San Francisco *Call*, and the pith of the Australian's statement is appended: "Labor is very scarce in Australia. We surely need laborers, especially stevedores and coal passers. Building artizans are in great demand also. The wages there, while not as high as paid in the United States, are about the same as here, when living expenses are considered. Building workers there receive about $4.25 a day, but they rent cottages for about $4 a week and if they live in restaurant they can buy their two heartiest meals of the day for less than 25 cents. As you know, the Australian government has been controlled by the unions for possibly 3 years. I am afraid that unless the unions change their policy, there will be a revolution in Australia before long. It is a wonder to me that more American workmen do not come to Australia."

THE Minneapolis (Minn.) *Journal* for 3d inst., in a mere reference to the cost of the investigation of the gas rate charged by the local Gas Company, says that such cost "Advanced to $125 per day, when 'Professor' William D. Marks filed the May 1 statement, making the total approximately $6,800, including furniture purchased for the expert and his assistants. The bill showed the change to flat rates of $7.50 a day each for two young women stenographers, whose hotel bills, averaging $39 a week each under the expense system, were the subject of a recent discussion in the Public Lighting Committee. The cost of the investigation is now placed at 'about $10,000,' instead of the first estimate of $8,000." It would look in this instance that the hire of the laborer was worthy of a better job!

THE voters of Abilene, Tex., in a total vote of 688, decided to indorse the giving of a franchise to J. J. Donelan and associates, under which to operate a gas plant in the named place. The vote was: In favor, 638; against, 50. The plant on the scale proposed will cost about $60,000.

MR. GEORGE D. CONLEE, formerly Superintendent of the Binghamton (N. Y.) Gas Company's works, has been appointed Superintendent of the Chuctanunda Gas Light Company, of Amsterdam, N. Y.

"AT the annual meeting of the U. G. I. Company, Mr. Sidney F. Tyler presided, and Mr. G. W. Curran occupied the Secretary's desk. The Directors elected were: Effingham B. Morris, Wm. Wood Thomas Dolan, Morris L. Clothier, Randal Morgan and Rudulph Ellis. The Directors subsequently chose Mr. Samuel T. Bodine as President. I know that you virtually made this presentation not long ago; but I forward it as a preface to other action taken by the Company in respect of the death of Mr. Clement A. Griscom, who, though perhaps not as well-known to the fraternity as Mr. Dolan, was animated by the like spirit which actuated the course in life of the latter. The resolution and minute, which were most feelingly presented by Mr. Bodine, were these:

"CLEMENT A. GRISCOM: The President announced the death of Mr. Clement A. Griscom, as of the tenth day of November, 1912;

"*Whereupon*, the following preamble and resolution were unanimously adopted:

"*Whereas*, Clement A. Griscom was, from January fourteenth, 1892, until his death, upon November tenth, 1912, continuously a member of this Company's Board of Directors, performing the duties of such office with zeal, integrity and good judgment.

"*Resolved*, That, in recognition of his services on behalf of the corporation, and in expression of the respect for his memory entertained by the shareholders, this minute be inscribed on the records of the corporation.—L."

MR. FRANK J. ESPIE, of West Fitchburg, Mass., is carrying on a flat-iron demonstration, the ironer being of the gas variety. He, however, unlike some others who "demonstrate" irons of either the gas or electric type, does not find it necessary to give the devices to the consumer. The irons are sold at cost, and his employers (the Fitchburg Gas and Electric Company) believe that that which is worth, first, having and, second, retaining, is worth paying for. This may seem a very small matter, but it nevertheless has a moral which will bear the pointing.

MR. NELSON GARDNER has severed his connection with the office force of the Old Colony Gas Company, East Braintree (Mass.) division.

AT the meeting for reorganization of the Gulf Gas Company, held in Biloxi, Miss., some days ago, this result was reached: Directors, John T. Schley, A. L. Staples and C. D. Willoughby, Mobile, Ala.; and C. B. McKinney, of Biloxi. President, John T. Schley; Vice-President, C. D. Willoughby; Secretary and Treasurer, A. L. Staples.

CONSTRUCTION work on the plant of the Statesville (N. C.) Gas Company has been resumed. This work was temporarily interrupted by the failure of the promoter, Sidney Kelly, of Philadelphia, to meet some of his obligations. However, those in charge of the completion of the task are altogether able to speedily carry out such purpose.

THE Lowell (Mass) Gas Light Company is constructing an up-to-date plant for the refining of the tar produced on its works. The still will have the dimensions of 15 feet by 13 feet, and the installation also calls for 2 storage tanks, with a capacity of 15,000 gallons each. The probable cost is put at $7,000.

THE proprietors of the Portland (Me.) Gas Light Company have determined to build a suitable office structure on the plot owned by the corporation, Nos. 3, 5 and 7 Temple street. The contemplated structure will have a dimension of about 70 feet square, and will be 3 stories in height, and will in every sense be thoroughly adapted to the Company's needs. The location is in the best business center of the city, and it is expected that the structure will be ready for occupancy by November 1st.

NEWS from Toronto, Ont., dated the 9th inst., is to to effect that a corporation is to be formed, under what is known as the "Ontario Companies Act," for the purpose of supplying and distributing artificial and natural gas to and through the counties of Essex, Kent, Middlesex, Elgin, Brant, Wentworth, Lambton, Norfolk, Welland, Haldimand, Lincoln, Oxford, Waterloo and Wellington. This enumeration, it will be seen, covers about the entire Western section of Ontario. The organization is virtually given the right to control the smaller companies in the field by the purchase of the shares thereof, but it is not given franchise rights other than those permitting it to pipe gas from the point of production to consumer. This enabling, however, is so restricted that it is obliged to obtain franchises from the various municipalities in which it seeks to transact business. It is capitalized in $15,000,000.

AT the annual meeting of the Scranton (Pa.) Gas and Water Company the officers elected were: Directors, George B. Smith, W. W. Scranton, Joseph Jeffrey, Worthington Scranton and E. P. Kingsbury. President, W. W. Scranton; Vice-President, Worthington Scranton; Secretary and Treasurer, Joseph Jeffrey; Superintendent, E. M. Stack.

THE Fall River (Mass) Gas Works Company, now constructing a new and modern coal gas plant, on a plot quite removed from the location of the present works, has arranged for the placing therein of a 36 inch concentrator for the recovery of free and fixed ammonia, to be furnished by the Gas Machinery Company, of Cleveland, O. The named firm will also install a P. & A. tar extractor and a tar and ammonia washer.

MANAGER DE FREESE, of the Chattanooga (Tenn) Gas Company, has assured the residents of the outlying section known as Woodland Park that gas mains will be extended to and put through that settlement before the summer season is well commenced.

The Market FOR GAS SECURITIES.

The changes since last week in market quotations for Consolidated to all intent show no variance. Last Friday the figures were 129½ to 130; this Friday the figures are 129½ to 129¾. Some stock changed hands in the interim, all transfers having been made within a range of 2 points. A circularizing house to-day (Friday) pays quite some attention to the affairs of the Standard Gas Light Company, of this city. Having noted that in 1909 the gross earnings were a total of $1,666,000, and that in 1912 they were only $1,735,000, the argument is, operating expense having increased in much greater ratio, chiefly through increased taxation, that in due course the surplus available for dividends ($618,935, in 1909, and $595,884 in 1912) will virtually be wiped out. The Company last year paid 6 per cent. on the preferred and 3 per cent. on the common, as against 6 per cent. and 4 per cent., respectively, in 1911, and it is thought that next half yearly dividend payments (declarable next month) will be at the rate of 6 and 3 for 1913, with a fair cut therefrom in surplus. In this connection it should be noted that 95 per cent. of the total capital is owned by the Consolidated Compan, wherefore this public article looks like the day of the Standard to go out of business is close at hand.

Outside shares are in general in poor demand at lowering prices, which looks to the writer exceptionally strange, especially in respect of Peoples, of Chicago, and Laclede, of St. Louis, which are increasing net earnings in a way that should convince the swiftest running reader that real value is the backing of these shares. The bond market keeps fairly active. Washington (D. C.) gas is well above 425.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

115 BROADWAY, NEW YORK CITY.

MAY 19.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked*
Consolidated Gas Co.	$99,816,500	100	129⅝	129¾
Central Union Gas Co.—				
1st 5's, due 1927, J. & J.	3,500,000	1,000	101	103
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	106	108
Mutual Gas Co.	3,600,000	100	157	157
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	101	102½
New York & Richmond Gas				
Co. (Staten Island)	1,500,000	100	59	63
1st Mtg. Gold Bds. 5 p. ct.	1,500,000	—	98¼	100½
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	103	105
Con. 5's, due 1945, J. & J.	1,500,000	—	98	100
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	100	102
Standard	5,000,000	100	102	104
Preferred	5,000,000	100	99	100
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	103	105
The Brooklyn Union	15,000,000	1,000	128¼	130
1st Con. 5's, due 1948, M. & N.	15,000,000	—	106¾	107
Yonkers	299,650	500	130	—
Out-of-Town Companies.				
Binghampton Gas Works	450,000	100	—	—
" 1st Mtg. 5's	509,000	1,000	97	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	83	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	59	60
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed				
Gold Bonds	7,500,000	1,000	104	105¼
Cincinnati Gas and Electric				
Co.	29,500,000	100	87	90
Columbus (O.) Gas Co., 1st				
Mortgage Bonds	1,500,000	1,000	96	98
Columbus (O.) Gas Lt. &				
Heating Co.	1,682,750	100	90¼	91
Preferred	3,026,500	100	75¼	80
Consumers, Toronto	2,000,000	50	300	304
Consolidated, Baltimore	13,460,084		118¾	119
Mortgages, 5's	8,400,000	—		—
General Mortgage 4½	10,661,000	—		—
Con. Gas Co., Baltimore				
City, 4½	2,751,000	—		—
Consolidated Gas Co. of N. J.	1,000,000	100	15	—
Con. Mtg. 5's	976,000	1,000	94	96
Bonds	75,000	—	—	100
Detroit City Gas Co.	6,580,000	—	—	50
Detroit Gas Co., 5's	881,000	1,000	75	80
" Prior Lien 5's	5,619,000	1,000	97	100¼
Equitable Gas & Fuel Co.,				
Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	133	136
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co.,				
1st Mtg. 5's	1,350,000	1,000	100	101
Hartford	750,000	25	190	200
Hudson County Gas Co., of				
New Jersey	10,500,000	—	130	132
" Bonds, 5's	10,500,000	—	101	103
Indianapolis	2,000,000	—	7	10
" Bonds, 5's	2,650,000	—	93	98
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co.,				
of Missouri	5,000,000	100	—	35
Bonds, 1st 5's	3,822,000	1,000	98¼	99
Laclede Gas Co., St. Louis.	10,000,000	100	99	94½
Preferred	2,500,000	100	99	102
Bonds	10,000,000	1,000	102¾	103
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	120	130
Madison Gas and Electric Co.				
" 1st Mtg. 6's	400,000	1,000	106	
Massachusetts Gas Companies, of Boston	25,000,000	100	89¼	90
Preferred	25,000,000	100	88	89¼ x
Montreal L. H.& P., Canada	3,000,000	100	224½	227
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	97	98
Bonds, 6's	6,000,000	—	127	128
New Haven Gas Co.	5,000,000	25	182	190

MEETING TIMES OF THE VARIOUS GAS ASSOCIATIONS.

American Gas Institute.—Annual meeting, Richmond, Va., October 15-17, 1913. Officers: President, W. R. Addicks, New York City. Secretary, Geo. G. Ramsdell, 29 West 39th st., N. Y. City.

Canadian Gas Association.—Annual meeting Sept. 1913. Officers: President, Arthur Hewitt, Toronto, Ont.; Secretary and Treasurer, John Keillor, Hamilton, Ont.

Empire State Gas and Electric Association.—Annual meeting, New York City, Oct. 8, 1913. Officers: President, C. G. M. Thomas, Long Island City, N. Y.; Secretary, C. H. R. Chapin, 29 W. 39th street, New York City.

Gas Meters.—Monthly Section Meetings; Grand Commissioner, I. W. Peffly, New York; Gen'l Sec'y, H. Thurston Owens, La Crosse, Wis.; New York Section, Chairman, Will W. Barnes; Secretary, John M. Brock, 204 Percy street, Flushing, N. Y. Philadelphia Section; Chairman, L. R. Dutton; Secretary, H. F. Patterson, Jr., 831 Chestnut street. Cleveland Section, Chairman, F. R. Hutchinson; Secretary, Wm. Holtz, East Ohio Gas Co. New England Section, Chairman, F. M. Roberts, Haverhill; Sec., F. K. Wells, 69 Broad street, Boston. Winona Section, Winona, Minn., W. F. Clausen, Chairman.

Guild of Gas Managers of New England.—Annual meeting, March, 1913. Young's Hotel, Boston; monthly meeting, second Saturday. Officers: President, Walter G. Africa, Manchester, N. H.; Secretary, H. K. Morrison, Brockton, Mass.

Illinois Gas Association.—Annual meeting, March 18th and 19th, 1914. Chicago, Ills. Officers: President, W. F. Barrett, Chicago, Ills.; Secretary-Treasurer, Horace H. Clark, 115 No. Oak Park avenue, Oak Park, Ills.

Illuminating Engineering Society.—Annual meeting, ——— September, 1913. Meetings of Sections, monthly. Pres., Preston S. Millar; General Secretary, J. D. Israel, 29 W. 39th street, New York City. Sections: New York, Secretary, C. L. Law, 124 West 42d street. New England, Secretary, H. C. Jones, 10 High street, Boston, Mass. Philadelphia, Secretary, L. B. Eichengreen, Broad and Arch streets. Chicago, Secretary, J. B. Jackson, 28 North Market street. Pittsburgh, Secretary, J. C. Mundo, Oliver Building.

Indiana Gas Association.—Annual meeting, March —— —— 1914. Terre Haute. Officers: President, A. S. Cooke, Terre Haute; Vice-President, A. C. Blunn, Evansville; Secretary-Treasurer, Philmer Eves, Indianapolis.

Iowa District Gas Association.—Annual meeting, May, 1914; ——— Officers: President, B. C. Adams, Lincoln, Neb.; Secretary, G. I. Vincent, Des Moines, Ia.

Kansas Gas, Water and Electric Light Association.—Annual meeting, October —— 1913 ——— Officers: President, L. O. Ripley, Emporia, Kas.; Secretary and Treasurer, W. H. Fellows, Leavenworth, Kas.

Michigan Gas Association.—Annual meeting, September, 17, 18, 19, 1913; ——— Officers: President, W. S. Blauvelt, Detroit, Mich.; Secretary-Treasurer, Glenn R. Chamberlain, Grand Rapids, Mich.

Missouri Electric Light, Gas, Water Works and Street Railway Association.—Annual meeting, April, 1913; Mexico, Mo. Officers: President, P. A. Bertrand, Joplin, Mo.; Secretary and Treasurer, P. W. Markham, Brookfield, Mo.

National Commercial Gas Association.—Annual meeting and gas show, Dec. 1-6, 1913. Philadelphia, Pa. Officers: President, C. W. Hare, Philadelphia Pa.; Secretary, Louis Stotz, 29 West 39th street, New York City.

Natural Gas Association.—Annual meeting, Cleveland, O., May 20 22, 1913; Officers: President, M. B. Daly, Cleveland, O; Secretary, T. C. Jones, Delaware, O.

New England Gas Association.—Annual meeting, February, 18th and 19th, 1914 Boston. Officers: President, T. H. Hintze, Providence, R. I.; Secretary-Treasurer, N. W. Gifford, East Boston, Mass.

New Jersey State Gas Association.—Annual Meeting July —, 1913, Asbury Park N. J. President, C. F. Butcher, Freehold, N. J.; Sec'y-Treasurer, O. F. Potter, Newark, N. J.

Ohio Gas Association.—Annual meeting, February ———, 1913, Columbus, O.; President, John M. Garard, Columbus, O.; Secretary, L. B. Denning, Columbus, O.

Oklahoma Gas, Electric and Railway Association.—Annual meeting, Oklahoma City May, ——1913. President, F. W. Caldwell, Shawnee, Okla.; Secretary, H. V. Bozell, Norman, Okla.

Pacific Coast Gas Association.—Annual meeting, San Jose, Cal., September 16, 17, 18, 1913. Officers: President, Henry E. Adams, Stockton, Cal.; Secretary-Treasurer, Henry B stwick, 445 Sutter street, San Francisco, Cal.

Pennsylvania Gas Association.—Annual meeting, Allentown, Pa., April ———, 1914; Officers, President, J. A. Frick, Allentown, Pa.; Secretary-Treasurer, W. O. Lamson, Jr., West Chester, Pa.

Society of Gas Lighting.—Annual meeting Dec., 11, 1913; monthly meetings, second Thursday. Place, New York City. Officers: President, Fred. S. Benson; Secretary, George G. Ramsdell, 29 West 39th street, New York city

Southern Gas Association.—Annual meeting, Mobile, Ala., April 4, 1914, Officers: President, James Ferrier, Rome, Ga.; Secretary-Treasurer, E. D. Brewer, Atlanta, Ga.

Southwestern Electrical and Gas Association.—Annual meeting. May 21, 22, 23 and 24, 1913, Galveston, Tex. Officers: President, F. M. Lege, Jr., Galveston, Tex.; Secretary H. S. Cooper, 405 Slaughter Bldg., Dallas, Tex.

Wisconsin Gas Association.—Annual meeting, May 14 and 15, 1913, Milwaukee, Wis. Officers: President, I. F. Wortendyke, Janesville, Wis.; Secretary-Treasurer, Henry Harmon, Milwaukee, Wis.